This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

LANE MEDICAL LIBRARY STANFORD
2 45 0179 7702

The Arteries

of the

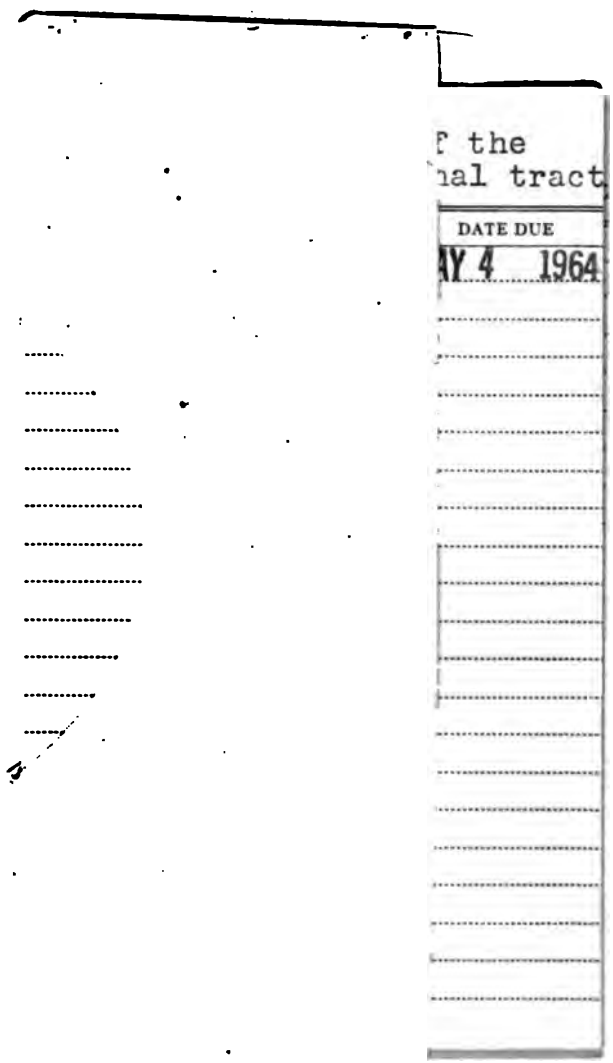
Gastro-Intestinal Tract

with

Inosculation Circle

— Hiroshi Hoshiyama

692



Algebra

Date Due			
MAY 4	1964		

692

Delaware

Date Due			
MAY 4	1964		

The Arteries of the Gastro-Intestinal Tract

WITH

Inosculation Circle

Anatomy and Physiology with Application in Treatment

BYRON ROBINSON, B. S., M. D.
CHICAGO, ILLINOIS

Professor of Gynecology and Diseases of the Abdominal Viscera in Chicago College of Medicine and Surgery. (Medical Department of Valparaiso University) Consulting Surgeon to Mary Thompson Hospital for Women and Children.

Author of "PRACTICAL INTESTINAL SURGERY," "LANDMARKS IN GYNECOLOGY," "LIFE-SIZED CHART OF THE SYMPATHETIC," "ABDOMINAL AND PELVIC BRAIN, WITH AUTOMATIC VISCERAL GANGLIA." "COLPOPERINEORRHAPHY AND THE STRUCTURES INVOLVED," "THE URETER," "PERITONEUM, ITS HISTOLOGY AND PHYSIOLOGY," "SPLANCHNOPTOSIA," "MESOGASTRIUM," "ARTERIA UTERINA OVARICA"

The Function of the *Inosculation Circle* is to Congest its Peripheral Viscus and to Transport Blood Volume from one Viscus to Another.

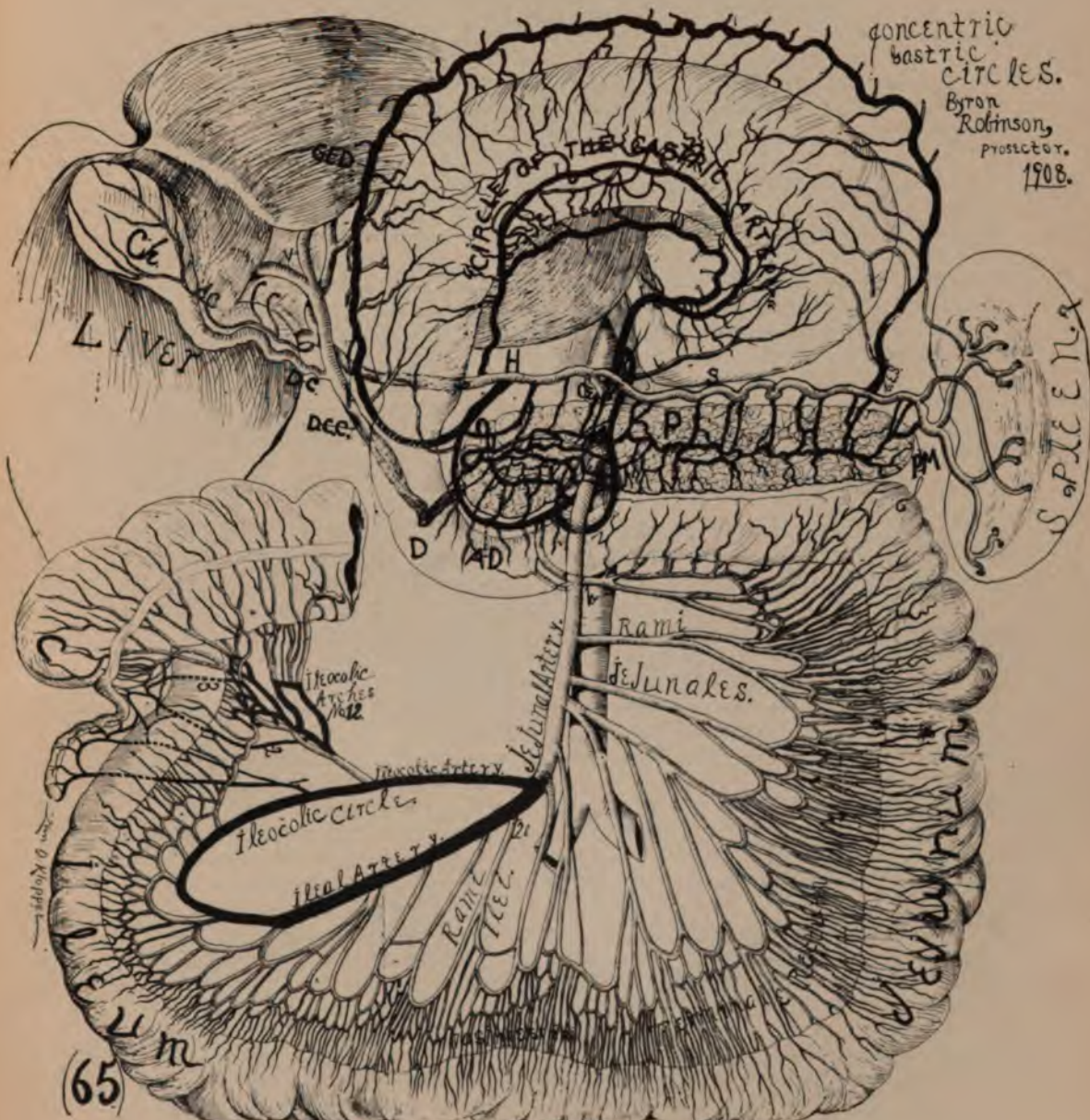
Chicago, Ill.
E. H. COLEGROVE
1908

COPYRIGHTED BY
BYRON ROBINSON
1903

'66
908

THIS MONOGRAPH IS DEDICATED TO
DR. J. CHALMERS DA COSTA
IN RECOGNITION OF HIS MERITORIOUS CONTRBUTIONS
IN MEDICINE

11501-1
NOV 2 1950



Arteries of the Gastro-Intestinal Tract

with

INOSCULATION CIRCLE

PREFACE.

The preface should be a key to the intention of the book. The intention of this book is to expose from the solid ground of nature anatomy and physiology of the *arteries* and *"Inosculation circles"* of the gastro-intestinal tract for the utility of medicine and surgery.

This book will present new anatomic and physiologic applications in the landmarks of the gastro-intestinal arteries.

The progressive advancement and blooming of intestinal surgery demands practical guiding landmarks.

A landmark is a point for consideration—anatomic, physiologic, pathologic.

As significant original and practical vascular landmarks and the "Inosculation circle" in the tractus intestinalis I present (1) the *"Concentric Gastric circles,"* (2), *"Ileocolic Circle;"* (3), *"Entero-colic circle;"* (4), *"Gastro-enterolic Circle;"* (5), *"Pancreatic Circle;"* (6), *"Ileocolic Arches."*

I have introduced the terms *Jejunal artery* and *Ileal Artery* as rational nomenclature to designate definite segments of the proximal mesenteric artery.

The terms, *"Circle of the Gastric Artery"* and *"Circle of the Pancreatic-duodenal artery"* and *"Pancreatico-colic artery"* I propose for professional consideration.

Friederich Tiedeman (1781-1861), Professor of Anatomy in Heidelberg founded Angieology. He worked 17 years on the arteries. His labors sufficed for the surgery of his day in Heidelberg, (1822), while his illustrations are copied in almost all standard Anatomic text books of today.

Today surgery demands a definite exposition of the arteries of the tractus intestinalis to meet its advanced requirements, specially of resection, as the chief matters to manage in intestinal resection is the blood supply.

In this monograph, from the solid ground of nature we have illustrated the dissected, exposed arteries—and also directed attention to important vascular landmarks, especially the "inosculation circles"—points for consideration—in anatomy, physiology and pathology.

The study of anatomy is for utilization in the unlimited field of physiology and also for a guide in the limited fading field of surgery.

Practical anatomy is a matter of averages.

The crux, the rock and base of the circulation is what I term the "inosculation circle," which is markedly influenced by therapy.

An "inosculation circle" consists anatomically of a vascular arc, a peripheral viscus with automatic, specialized peripheral ganglia, the stimulation of which initates and sustains common visceral function (sensation, absorption, secretion, peristalsis) and special function if it be the "utero-ovarian circle" (ovulation, menstruation, gestation).

Since a physician's duty is practically limited to the field of pathologic physiology, the rock and base of medical practice rests on physiology. Vast potentialities lie in the practical control of physiologic function.

Physiology in general and to a special degree surgery utilizes anatomy—physiology and surgery are the precursors of anatomy. Physiology dominates anatomy. Function precedes structure, (especially evident in embryology). Form is less permanent than function. The most hopeful therapeutic field lies in utilization of the blood volume in the "inosculation circle" precisely as physicians have successfully practiced on the "utero-ovarian circle." The object of the "inosculation circle" is to engorge its peripheral viscus and to transport blood volume from one

viscus to another. The "inosculation circle" possesses automatic, specialized peripheral ganglia (Auerbach's, Billroth-Meissner's, or genital ganglia—in short automatic ganglia) the stimulation of which dilates its vessels with consequent maximum engorgement of the peripheral viscus and resulting in maximum visceral elimination. The following views are advocated in the book, viz.:

Blood cures disease.

A cell lives in water.

A cell functionates in a fluid medium.

The apparatus for executing visceral hyperaemia is the "inosculation circle."

The object of the "inosculation circle" is to engorge, to congest its peripheral viscus and to transport blood volume from one viscus to another.

The means of functionating the "inosculation circle" is by stimulating its automatic specialized peripheral ganglia (Auerbach's, Billroth-Meissner's, genital, etc., etc.), which dilates its vessels resulting in maximum visceral hyperaemia and maximum visceral elimination.

A maximum blood volume occupying an "inosculating circle" excites the common function of viscera (sensation, absorption, secretion, peristalsis).

The chief rational therapeutics for the "inosculation circle" is VISCERAL DRAINAGE (i. e. the administering of ample fluids at regular intervals), which produces maximum visceral hyperaemia and maximum visceral elimination.

The arteries of the gastro-intestinal tract are solidly and compactly anastomosed and hence masses of food or faeces (points of local irritation) may entice blood from the general intestinal circulation to any local intestinal segment for special localized function, (sensation, secretion, absorption, peristalsis).

In this little book travels my half dozen family of eponyomic children.

Labor's hand has paid their fare for an endless journey.

In research work, we know not in what it will end. We begin with one or several preconceived ideas, and flounder in the facts whence revelations come.

Research is not merely to know the truth, but to discover something that will benefit some man or animal.

The birth and development of a new idea is like the birth and development of a child. It is like the rising of a sun.

One of the chiefly desired objects of this book is to present the unlimited utility of the *"inosculation circle"* in the cure and prophylaxis of disease.

The rushing current of blood to congested, diseased parts, to infected diseased areas is sufficient evidence that blood cures disease and the ability of the physician to control blood volume in the "inosculation circle" enables him to imitate nature.

For significant purposes I shall classify this monograph in three chapters to correspond with the three great intestinal arteries, viz., coeliac artery, proximal mesenteric artery and distal mesenteric artery, the remainder will be designated as sections.

I am aware that numerous repetitions occur in the monograph for the reason that each section and chapter were completed independently and separately and fragments of the same were published in the following medical journals, Milwaukee Medical Journal, Medical Fortnightly, American Journal of Dermatology, Physician and Surgeon, American Medical Compend, Medical Standard. The illustrations were produced by the well known artist, Dr. Zan D. Klopper, from my personal dissections and directions. Neither time nor expense were spared in executing them from the solid ground of nature.

Dr. Thomas G. Atkinson, editor of the *Medical Standard* and favorably known as an able editorial writer contributed an introduction.

BYRON ROBINSON.

May, 1908, Chicago, Illinois.

SECTION I.

INTRODUCTION.

THOMAS G. ATKINSON, M. D.

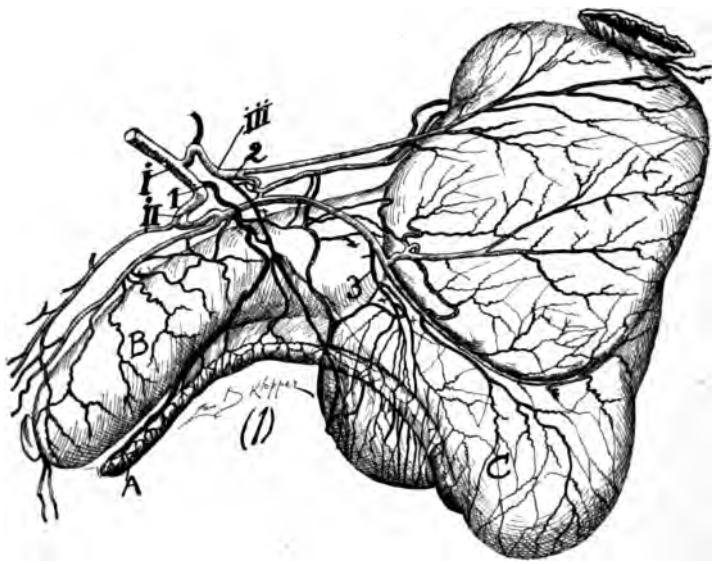
Presumably to every thinking, imaginative man there come supreme moments and special agencies of illumination upon the various problems of life with which he is engaged. Such a revelation came to me upon the subject of the human body through my study of the physiologic process of metabolism, and set it in a light which, for me, has never since ceased to illumine it. Theretofore, under the formalism of anatomy (whose momentous importance, withal, I have not the least intention of belittling) the living body had appeared to me as a sort of set-piece, much the same as the cadaver I was dissecting, except that in the cadaver the machinery had stopped, filled as to its vessels with a given quantity of blood, much as the cadaver was injected with fluid, which was kept in motion by an automatic pump, and wired with an intricate scheme of nerve trunks and exchanges.

With the study of physiology, of which metabolism happened to be the first phase I took up, the matter took on a different aspect, which colored the whole subject. It became apparent that the body, instead of being a static structure, is rather in the nature of a visible dynamic process—a short circuit arc, so to speak, between two poles, whose higher and lower potentials consist respectively of the anabolic and katabolic influences of its environment, whose structural form represents simply the plastic moulding of the medium into lines of least resistance, and whose coefficient of vitality might be expressed by the net potential divided by the resistance.

It is as though a man, viewing a tree between himself and the light, should suddenly have revealed to him the myriad interlacery of filament and vein, and in the flush of the disclosure should exclaim: "These are the hidden sources of the tree's life and growth." Such a conclusion—the first impression of anatomy—we know, in the light of physiology, to be wrong. The sunlight, by which the structural network is revealed, its warmth, its actinic energy; the air, its motion, its gaseous pressure, its moisture; these are the true sources of the vitality and development of the tree. The structural forms which enthral the beholder are the ultimate reaction of the cells to the kinetic dynamism which constitutes the tree; they are the paths blazed by this dynamism between its two poles.

In the light of this simple and unifying conception one or two transcendent principles stand out very clearly, and serve as touchstones for all of our theories and practices concerning anatomy and physiology, both normal and pathologic.

First, it is clear that function, i. e. the flow of vital energy between the two potentials, is one, indivisible, supreme. The complex group of phenomena which we call, in the plural number, functions, are integral ramifications of the one indivisible process, called forth by the necessity of establishing a path of least resistance between the anabolic and katabolic poles, both of which are complex And it is the normal operation of this function, i e., its proper ramification into minor functions so as to bring about and maintain a path



APPENDICULAR ARTERY.

Fig. 1. The right colon, coecum, ileum and appendix is distended with air and dried. Dorsal view. I., ileo-colic artery. II., arteria ileocaecalis dorsalis. III., arteria ileo-caocalis ventralis. A, appendix. C, coecum (symmetrical). B. ileum (coecum symmetrical).

1, arteria appendicularis (main artery) from arteria ileo-coecalis dorsalis. 2, arteria appendicularis from arteria ileocoecalis ventralis. 3, arteria appendicularis from arteria ileo-coecalis dorsalis. The subject had three arteries attending the appendix. The three appendicular arteries divide into numerous branches. The length of the appendix was some over five inches in length. See section II., page 13.

Ileo-colic arches, 5. There is considerable difference in the appearance of the blood supply to the specimen as regards the distended or contracted state of the organs. Appendix located parallel to distal ileum.

of least resistance, that constitutes health and life, its compromise which constitutes disease and death.

In common language, function determines structure, and function is the kinetic adaptation of the parts to the ends of the whole. In human ecomony, the functions of circulation, respiration, and cerebration, elimination, etc., by which the man as a whole corresponds, positively and negatively, with his environment, fashion the vascular, respiratory, nervous, and emunctory systems, which in turn shape the minute anatomical arrangements which we call structure.

The second principle elucidated by physiology is an inverse perspective of the first. Structural forms and arrangements, being the plastic adjustment of matter into lines of least resistance—the paths blazed by the dynamism of function—constitute a scheme of which plenary function is the key. And any demonstration of anatomy, gross or minute, which falls short of this signification, is incomplete, either from insufficiency of the data or from lack of illuminative insight to discern their import.

In the case of those anatomic structures whose mode of functioning is as yet obscure, it is of course impossible to establish any relationship between the structural scheme and the functional maximum. That is a task for the anatomy of the future. But in those physiologic systems which meditate directly, and by well-recognized mechanism, between the anabolic and katabolic poles—e. g. the vessels which carry oxygen and nourishment to and from the tissues, and the neurones which bear currents to and from the conscious centers—this orienta-

tion of anatomic structure by the touchstone of functional capacity can and ought to be demonstrated to the last degree of satisfaction.

A third and highly utilitarian principle unfolding itself from this dynamic conception is that which concerns the pathologic aspect of the matter. Since structure plays a wholly passive role in the normal process, it is clear that it cannot and does not, in the ordinary course of events, play any active part in the induction of deviations from the normal. Normal structure has in itself no power either to thwart, or beyond normal limits to resist, the plastic influence of function. Function works its own sweet will upon normal structure, and the latter has no choice but to submit. Hence, in the ordinary course, all deviations from the normal originate with defective or perverted function.

There are, of course, individual cases, especially in the domain of surgery, where a primary distortion of structure (usually of gross structure) frustrates the proper working of a normal function. Such cases are accidents, to which all physical processes are liable. Occasionally there are instances in the internist's experience where an inherited defect of structure (usually of minute structure) offers a similar hindrance to normal function. But such instances are rare. In the vast majority of cases—so large a proportion as to constitute the rule—structural changes are the responsive reaction of structure to functional defects or perversions, having their origin in either the anabolic or the katabolic relations between organism and environment.

He is the most skillful and rational physician who can discern the course of these pathologic processes, and apply the remedial influence, whether it be a drug or a suggestion, at a point nearest to their functional origin and furthest from their structural effects. The signs of the time point strongly to a state of knowledge, not so far distant, when all disease shall be reconnoitred and repulsed at these functional outposts, and the sphere of medical influence be brought within that field which lies between normal function and abnormal structure—the field of pathologic physiology.

What has all this to do with the work of my friend, Byron Robinson, upon the blood supply of the abdominal viscera? Directly, perhaps, very little; indirectly, everything in the world. Following out the general view here expounded, a man's specific work must be read in the light of the man himself and his overlaying motive. The man orientates and punctuates his work.

Byron Robinson is an anatomist. Probably no one man has made more original or valuable contributions to anatomical knowledge. The number and thoroughness of his autopsies are known and admired of all men. Yet no man has so clearly recognized or so consistently taught the functional significance of his findings. Especially in those regions where his special work lies, the intestinal, urinary, and genital tracts, has he reduced physiology to elementary principles, established an indisputable link between these elementary functions and the higher functions of life, not only by his sound reasoning, but by the convincing logic of his post-mortem scalpel; deduced rational methods of treatment from these premises; and persistently raised his voice against the unwarranted violation of functional principles by irrational surgery.

The more anatomy he explores and demonstrates, the more physiology he deduces and justifies. Every new structural discovery that he unearths he drags inexorably to the tribunal of physiology, to determine its functional value. Found wanting under this test, he distrusts the thoroughness of his data, and digs for more anatomy, until his findings disclose a definite functional significance.

His present work is dominated by this same far-seeing philosophy. Functionally the crux of circulation is anastamosis or inosculation. For the blood is the life. "Blood," so Byron Robinson teaches in and out of season, "cures disease and prevents it." But only dynamic blood; only blood that circulates,

which in this sense means the closing of a circuit rather than the describing of a circle; blood that makes a live contact between the extreme poles of metabolism —between the agencies that upbuild and tear down the tissues. And the anatomic and physiologic crux of this dynamism, this circuit, this contact,—important to the normal functions, vastly more important to the repair of pathologic function, I repeat, is anastomosis or inosculation

The significance of this truth was long ago recognized in respect of the cerebral circulation, and its structural vindication demonstrated in the Circle of Willis. Imbued with a sense of the general physiological importance of this, Byron Robinson several years ago set to work to elaborate a similar circuit in the pelvis, and gave to the world his classic demonstration of the "*Utero-Ovarian Circle*" which now bears his name.

Working for the most part along the same line, not because he had fallen into a rut but because the underlying principle of anastamosis seemed to warrant a universal working out, he has now succeeded in demonstrating a silimar classic form of anastamosis in the abdominal and pelvic blood supply.

The first of these anastamotic circuits has for its cardinal poles the mesenteric and the ileo-colic arteries, whence it may be eponymized as the "*Ileo-Colic Circle.*" Its demonstration is of immense importance, not only in explaining many hitherto obscure medical and surgical conditions of the ileo-colic region, but in furnishing invaluable data for the practical surgery of this region.

Subsidiary to this circle are what may be fitly termed the "*Ileo-Colic Arches,*" the termination of the ielo-colic artery at the junction of the ileum and colon in short strong anastamoses of the dorsal and ventral branches of the artery, which Byron Robinson has demonstrated average about six in each individual.

A similar system of anastamosis has been worked out by him between the gastric arteries and their tributary vessels, forming two distinct circles, one (the proximal) consisting of an inosculation of the gastric and hepatic arteries, lying along the lesser gastric curvature, while the other (the distal) having for its poles the gastro-epiploic and the hepatico-splenic arteries, lying along the greater curvature, and together forming what may be aptly termed the "*Concentric Gastric Circles.*" The influence of this contribution to anatomy and physiology upon medicine and surgery can hardly be overestimated.

Continuing along the great prima via, Byron Robinson has demonstrated a like anastamotic circuit between the arteries of the enteron and the colon by the inosculation of the transverse and left colic arteries, irresistibly suggesting for itself the eponym of the "*Entero-Colic Circle,*" and more recently a similar connection between the aorta and jejunal arteries on the one hand and the pancreatic branches of the coeliax axis on the other, which may be appropriately called the "*Pancreatic Circle.*"

In addition to these "inosculation circles" of arterial anastomosis, Byron Robinson has demonstrated in the lower bowel some still further ramifications of the blood supply, having an important bearing upon the physiology and surgery of the parts. These are short (but not too short for ligature) straight terminations of the mesenteric arteries in the enteron and colon, to which the eponym of the "Straight Terminal Vessels of the Intestines" is very applicable.

All of these anastamotic features are, so far as their demonstration is concerned, original with Byron Robinson, and all of highly practical vaue. They all unlock to the key of plenary functions, which orientates and gives them meaning. It is reasonable to predict that they will live as long as anatomy endures, and inasmuch as an eponym is ever the crystallization of all that the demonstration involves and implies, it is also likely that these contributions of Byron Robinson to anatomy and physiology will always bear the eponyms that have been aptly applied to them.

Chicago, May 1908.

SECTION II.

ABSTRACTS OF THE ESSENTIAL VIEWS CONTAINED IN THIS MONOGRAPH WITH SPECIAL REFERENCE TO THE "INOSCULATION CIRCLE" AND ILLUSTRATIONS

I. THE "CONCENTRIC GASTRIC CIRCLES."

There is a proximal and distal.

(a). *Proximal "gastric circle"* or gastrohepatic circle, the lesser of the two "concentric circles" is *formed* by the inosculation of the gastric and hepatic arteries, and a circle is completed by the arteria hepatica communis (common trunk of the hepatic and gastro epiploic arteries). The circle is *located* along the lesser gastric curvature. The dimension of the proximal "gastric circle" may measure 10 inches in circumference.

(b) *Distal "gastric circle"* or hepatosplenic circle, the greater of the two "concentric gastric circles" lying along the greater gastric curvature is *formed* by the inosculation of the gastro-epiloica (sinistra and dextra) and completed by the hepatic and splenic arteries. The dimension of the distal "gastric circle" may measure 20 inches in circumference. The *location* of the "concentric gastric circles" is adjacent to the greater and lesser gastric curvatures.

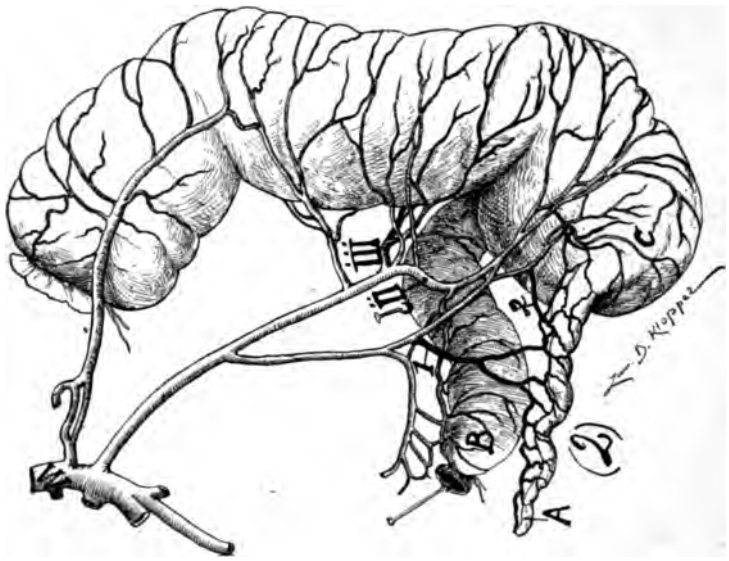
Surgically the gastrium lies getween the two "concentric gastric circles" which serve as a surgical guide and in gastrectomy a ligature is required at the right and left end of the gastric and gastro-epiploic arteries. In gastro-enterostomy the "concentric gastric circles" should not be obstructed. The arrangement of the blood apparatus of the stomach resembles that of the enteron and the colon. It consists of (1), a trunk (celiac axi); (2), a branch or arch of the proximal or distal gastric arteries (arteria gastrica and arteria gastro epiploica); (3), "straight terminal vessel," (rami gastrici).

The *clinical* signification of the "concentric gastric circles" is that they are the apparatus by which the gastric hyperaemia or engorgment is produced. The means of functionating the "concentric gastric circles" is by stimulating their automatic specialized peripheral *ganglia* (Auerbach's and Billroth's Meissner's) which dilates the caliber of the gastric and gastro-epiploic arteries composing them, whence the gastric wall becomes engorged, flooded with blood. The "concentric gastric circles" are typical *inosculation circles*, the object of which is to produce maximum hyperaemia, engorgement, of the peripheral viscus, (stomach) or to transport blood from one viscus (e. g. stomach) to another (e. g. enteron). *Anatomically* the "concentric gastric circles" are a vascular land mark and a surgical guide. The *function* of the "concentric circles" is to engorge the stomach (their peripheral viscus).

The *utility* of the eccentric gastric circles is *Physiologic.* to maintain a continuous maximum blood volume to the stomach with maximum collateral circulation for functional purposes (sensation, secretion, peristalsis, absorption) —not merely to nourish the stomachic structures.

II. THE "ILEOCOLIC CIRCLE."

The "Ileocolic Circle" is *formed* by the bifurcation of the jejunal artery



ARTERIA APPENDICULARIS.

Fig. 2. The right colon, coecum, appendix, and ileum distended and dried. Dorsal view. M, proximal mesenteric artery. I., arteria ileo-colica located between M and the division of the ileo-colic artery; II., arteria ileo-colica dorsalis; III., arteria ileo-coecalis ventralis, C. coecum (symmetrical). B, ileum. A, appendix.

1, arteria appendicularis (main vessel) from the arteria ileo-coecalis dorsalis; 2, arteria appendicularis (secondary vessels) from the arteria ileo-coecalis dorsalis. The appendix is attended by two arteries. The appendicular arteries divide into 11 branches. Appendix located parallel to distal ileum.

Ileo-colic arches, 4. Observe the bifurcation and re-anastomosis of the arteria ileo-colica forming an arterial circle. The right distal "major meso-colic circle" is present. **See section II, page 13.**

into the ileocolic and ileal arteries and completed by their distal inosculation. The "Ileocolic Circle" is *located* in the ileocolic angle and is a constant structure. It may be accompanied by mesenteric appertures, from insufficient vascular nourishment, which may serve for hernial strangulation. The "Ileocolic Circle" is frequently divided into apartments by arteries of varied dimensions which are destined to nourish the mesentery within the circle or are bifurcated loops, branches of the main circle.

The *dimension* of the "Ileocolic Circle" existing in the form of an oval measures frequently 2x6 inches. The dimension of the "Ileocolic Circle" depends chiefly on the location of the bifurcation of the jejunal artery which may bifurcate proximal, on a level or distal to the origin of the distal mesenteric artery. The "Ileocolic Circle" may possess imposed on its periphery a series of minor vascular arches. The "Ileocolic Circle" is a primordial vascular landmark destined to nourish the ileum and cecum (with the appendix as an ancient stomach). The "Ileocolic Circle" is associated and in relation with the right psoas, distal ileum, cecum, right colon, ureter, common iliac vessels and the treacherous, dangerous appendix to which it primarily chiefly and directly emits the vascular supply. It is directly associated with the "ileocolic arches."

The *clinical* significance of the "Ileocolic Circle" is that its right circumference (i. e. the ileocolic artery composed of ileocolic trunk and ramus iliacus), is the main source (in 96% of subjects) of origin of the arteria appendicularis which alone will immortalize it. The "ileocolic circle" is a typical ***inosculation***

circle the object of which is to engorge congest its peripheral viscus (enteron and colon) or to transport blood volume from one viscus (enteron) to another (colon). The "Ileocolic Circle" possesses automatic specialized peripheral *ganglia* (Auerbach's and Billroth's Meissner's) which being stimulated dilates the caliber of the artery composing it. *Anatomically* it is a primordial vascular land mark and surgical guide.

The *utility* of the "Ileocolic Circle" is *Physiologic* i. e., to furnish a continuous maximum blood volume to the distal ileum and cecum (also appendix) with maximum collateral circulation for functional objects (sensation, absorption, peristalsis, secretion).—not merely to nourish the structures it supplies.

The chief function of the "ileocolic circle" is to engorge its Peripheral viscus (enteron and right colon).

III. "PANCREATIC CIRCLE" (Arcus Pancreaticus).

Pancreatic Anastomotic Vascular Apparatus.—I here introduce the term "pancreatic circle" which is composed of the aorta and jejunal artery as one segment and the combined anastomoses of arterial branches within the pancreas, originating from the coeliac axis (with its 3 branches) and jejunal artery.

The pancreatic arc solidly and compactly anastomoses the coeliac axis (gastrium) and jejunal artery (enteron). The numerous pancreatic arteries (from the coeliac and jejunal arteries) entering the pancreas at numerous points, are not only relatively but absolutely of remarkable dimension as regards the moderate dimensions of the pancreas.

The pancreas is located on the periphery of the "pancreatic circle." The principle artery of the pancreas is the pancreatico-duodenal artery, however the pancreatico-duodenal artery is the "duodenal circle."

The "Pancreatic circle," is inseparably (anatomic and physicologic) connected with the "duodenal circle," for the coeliac axis (stomach) and jejunal artery (enteron) is united, inosculated by the combination of the "duodenal circle" and the "Pancreatic circle"—which combination should be termed "Gastro-enteronic circle," or ("Arcus gastricus Intestinalis").

The Pancreatic circle possesses automatic specialized peripheral *ganglia*, (Auerbach's and Billroth-Meissner's), the stimulation (by fluid and food) of which dilates, controls the caliber of the arteries composing it.

The *clinical* signification of the "Pancreatic circle" is its intimate association with the pancreas and "duodenal circles."

The *utility* of the "Pancreatic circle" is its capacity for transporting blood volume for function from the coeliac axis (liver and gastrium) to the jejunal artery (enteron) and vice versa.

The *object* of the "Pancreatic circle" is to engorge its peripheral viscus (the pancreas). The *functionation* of the "Pancreatic Circle" is produced by stimulation of its *automatic* specialized peripheral *ganglia* (Auerbach's and Billroth-Meissner's) which dilates the vessels composing it. Whence the pancreas becames engorged with blood. The "Pancreatic circle" presents not such a marked, distinct isolated vascular ring as other inosculation circles.

IV. THE "ILEOCOLIC ARCHES."

The "Ileocolic Arches," averaging six in number for each individual, are *formed* by the combined anastomosis of the dorsal and ventral ileocoecal arteries. *Anatomically* the "ileocolic arches" is a primordial vascular land mark of the cecum (and atrophying appendix). They serve for a surgical guide. The diameter of the anastomosing arteries are relatively large for the dimension of the arches. They are *located* in the ileocolic angle and typically resemble the mesosigmoid arches or other arches located in the flexures of the tractus intest-

ARTERIA APPENDICULARIS.

Fig. 2. The right colon, coecum, appendix, and ileum distended and dried. Dorsal view. M, proximal mesenteric artery. I., arteria ileo-colica located between M and the division of the ileo-colic artery; II., arteria ileo-colica dorsalis; III., arteria ileo-coecalis ventralis, C. coecum (symmetrical). B, ileum. A, appendix.

1, arteria appendicularis (main vessel) from the arteria ileo-coecalis dorsalis; 2, arteria appendicularis (secondary vessels) from the arteria ileo-coecalis dorsalis. The appendix is attended by two arteries. The appendicular arteries divide into 11 branches. Appendix located parallel to distal ileum.

Ileo-colic arches, 4. Observe the bifurcation and re-anastomosis of the arteria ileo-colica forming an arterial circle. The right distal "major meso-colic circle" is present. See section II, page 13.

into the ileocolic and ileal arteries and completed by their distal inosculation. The "Ileocolic Circle" is *located* in the ileocolic angle and is a constant structure. It may be accompanied by mesenteric appertures, from insufficient vascular nourishment, which may serve for hernial strangulation. The "Ileocolic Circle" is frequently divided into apartments by arteries of varied dimensions which are destined to nourish the mesentery within the circle or are bifurcated loops, branches of the main circle.

The *dimension* of the "Ileocolic Circle" existing in the form of an oval measures frequently 2x6 inches. The dimension of the "Ileocolic Circle" depends chiefly on the location of the bifurcation of the jejunal artery which may bifurcate proximal, on a level or distal to the origin of the distal mesenteric artery. The "Ileocolic Circle" may possess imposed on its periphery a series of minor vascular arches. The "Ileocolic Circle" is a primordial vascular landmark destined to nourish the ileum and cecum (with the appendix as an ancient stomach), The "Ileocolic Circle" is associated and in relation with the right psoas, distal ileum, cecum, right colon, ureter, common iliac vessels and the treacherous, dangerous appendix to which it primarily chiefly and directly emits the vascular supply. It is directly associated with the "ileocolic arches."

The *clinical* significance of the "Ileocolic Circle" is that its right circumference (i. e. the ileocolic artery composed of ileocolic trunk and ramus iliacus), is the main source (in 96% of subjects) of origin of the arteria appendicularis which alone will immortalize it. The "ileocolic circle" is a typical *inosculation*

circle the object of which is to engorge congest its peripheral viscus (enteron and colon) or to transport blood volume from one viscus (enteron) to another (colon). The "Ileocolic Circle" possesses automatic specialized peripheral *ganglia* (Auerbach's and Billroth's Meissner's) which being stimulated dilates the caliber of the artery composing it. *Anatomically* it is a primordial vascular land mark and surgical guide.

The *utility* of the "Ileocolic Circle" is *Physiologic* i. e., to furnish a continuous maximum blood volume to the distal ileum and cecum (also appendix) with maximum collateral circulation for functional objects (sensation, absorption, peristalsis, secretion).—not merely to nourish the structures it supplies.

The chief function of the "ileocolic circle" is to engorge its Peripheral viscus (enteron and right colon).

III. "PANCREATIC CIRCLE" (Arcus Pancreaticus).

Pancreatic Anastomotic Vascular Apparatus.—I here introduce the term "pancreatic circle" which is composed of the aorta and jejunal artery as one segment and the combined anastomoses of arterial branches within the pancreas, originating from the coeliac axis (with its 3 branches) and jejunal artery.

The pancreatic arc solidly and compactly anastomoses the coeliac axis (gastrium) and jejunal artery (enteron). The numerous pancreatic arteries (from the coeliac and jejunal arteries) entering the pancreas at numerous points, are not only relatively but absolutely of remarkable dimension as regards the moderate dimensions of the pancreas.

The pancreas is located on the periphery of the "pancreatic circle." The principle artery of the pancreas is the pancreatico-duodenal artery, however the pancreatico-duodenal artery is the "duodenal circle."

The "Pancreatic circle," is inseparably (anatomic and physicologic) connected with the "duodenal circle," for the coeliac axis (stomach) and jejunal artery (enteron) is united, inosculated by the combination of the "duodenal circle" and the "Pancreatic circle"—which combination should be termed "Gastro-enteronic circle," or ("Arcus gastricus Intestinalis").

The Pancreatic circle possesses automatic specialized peripheral *ganglia*, (Auerbach's and Billroth-Meissner's), the stimulation (by fluid and food) of which dilates, controls the caliber of the arteries composing it.

The *clinical* signification of the "Pancreatic circle" is its intimate association with the pancreas and "duodenal circles."

The *utility* of the "Pancreatic circle" is its capacity for transporting blood volume for function from the coeliac axis (liver and gastrium) to the jejunal artery (enteron) and vice versa.

The *object* of the "Pancreatic circle" is to engorge its peripheral viscus (the pancreas). The *functionation* of the "Pancreatic Circle" is produced by stimulation of its *automatic* specialized peripheral *ganglia* (Auerbach's and Billroth-Meissner's) which dilates the vessels composing it. Whence the pancreas becames engorged with blood. The "Pancreatic circle" presents not such a marked, distinct isolated vascular ring as other inosculation circles.

IV. THE "ILEOCOLIC ARCHES."

The "Ileocolic Arches," averaging six in number for each individual, are *formed* by the combined anastomosis of the dorsal and ventral ileocoecal arteries. *Anatomically* the "ileocolic arches" is a primordial vascular land mark of the cecum (and atrophying appendix). They serve for a surgical guide. The diameter of the anastomosing arteries are relatively large for the dimension of the arches. They are *located* in the ileocolic angle and typically resemble the mesosigmoid arches or other arches located in the flexures of the tractus intest-

inalis. At each colonic flexure (ileocolic, hepatic, splenic, sigmoid), there may occur an accumulation, a condensation of vascular arches. The "Ileocolic Arches" and are constant structures with constant location. The "Ileocolic Arches" serve as the vascular connection anastomosis between the enteronic and colic arteries.

The *clinical* signifaction of the "Ileocolic Arches" is included in their relation with surgical procedures on the cecum and appendix. They may be clamped or ligated without compromising the "Ileocolic Circle." The "Ileocolic arches" are essentially associated with the appendicular blood supply, secondarily and directly originating one or more appendicular arteries (in 95% of subjects). Practically the "Ileocolic arches"—though connected by anastomosis with colic and ileal arteries—appear as marked, independent, isolated structures, destined for the cecum. They are not, however, end arteries or loops as the tractus intestinalis may be injected through the "ileocolic arches."

The "ileo-colic arches" are typical anastomatic arches the object of which is to produce maximum physiologic hyperaemia, engorgement in their peripheral viscus, coecum, appendix, ileum) and to transport blood volume from one viscus to another.

At present from evolutionary processes the "ileocolic arches" are practically mesocolic arteries, specially localized and anastomosed. The "ileocolic arches" possess automatic specialized peripheral *ganglia* (Auerbach's and Billroth's Meissner's) stimulation of which dilates the caliber of the arteries composing it.

The *utility* of the "ileocolic arches" is *physiologic* i. e., to furnish a persistent maximum blood volume to the cecum (and appendix) with maximum collateral circulation for functional reasons (sensation, secretion, absorption, peristalsis)—not mainly to nourish the structures they supply.

The function of the "ileocoilc arches" is to engorge their peripheral viscus (coecum, appendix, ileum).

V. THE "ENTERO-COLIC CIRCLE."

The Entero colic arch, the Riolan-Haller Arch or arcus transversus colicus is *formed* by the inosculation of the arteria transversa colica (Exarteria jejunalis) with the arteria colica sinistra (Exarteria mesenterica distal.)

The right *origin* of the "Enterocolic Circle" is the jejunal artery, the left origin is the distal mesenteric artery. The "enterocolic circle" joins directly the proximal and distal mesenteric arteries.

The *location* of the "enterocolic circle" is in the transverse mesocolon.

Its *dimension* may measure 15 to 20 inches in circumference. It depends on the condition of the colic arteries (origin and coalescence) and the presence or absence of an accessory transverse colic artery (e. g. Waldeyer's Artery). Accessory or multiple arteries produces multiple arches which fortifies the integrity and increases the peripheral circulation.

The *clinical signification* of the "Enterocolic circle" or mesocolic arch is its intimate relations to the transverse colon, as regards hyperaemia for digestion, self nourishment, embolus and surgical procedures.

The "Entero-colic circle" is a *surgical* guide.

It is of extreme practical significance in *surgical procedures* on the colon that the "entero-colic circle" or the Riolan-Haller arch be not ligated or interrupted as it might jeopardize the colon to ulceration, gangrene. The Riolan-Haller arch may possess surmounted on its circumference a series of minor arches, mesocolic arch or significant in peripheral circulation. Waldeyer's artery makes more solidly and compactly the circulation of the transverse colon, the magnitude of which endangers peripheral circulation in the entero-colic circle. Multiple vascular arches insure ample peripheral circulation by abundant collateral anastomosis.

ARTERIA APPENDICULARIS.

Fig. 3. Specimen injected, distended, dried and used as a model by the artist, Zan D. Klopper. Dorsal view. I., arteria ileo-colica. II., arteria ileo-coecalis dorsalis. III., arteria ileo-coecalis ventralis. A, appendix. C, coecum (atrophic type). B, ileum.

1, arteria appendicularis (chief vessel) from arteria ileo-coecalis dorsalis et ventralis. 2, arteria appendicularis (secondary vessel) from the arteria ileo-coecalis ventralis. The two appendicular arteries are inosculated joined by an arch simulating the blood apparatus to other more vital segments of the tractus intestinalis.

The appendicular arteries distribute 12 branches to the appendix. Appendix located retro-ileac.

Ileo-colic arches, 5. Contracted and distended specimens differ in the appearance of the blood supply. Note the sinuosity of the vessels even with distention of viscera. The arteria ileo-coecalis dorsalis and arteria ileo-coecalis ventralis are solidly and compactly anastomosed. The right distal "major mesocolic circle" present. See section II, page 13.

During resection the transverse colon, the "straight terminal vessel" alone can be clamped or ligated, not the "entero-colic circle." Ligation or clamping of the "entero-colic circle" might jeopardize the transverse colon to ulceration gangrene.

The *functionation* of the "entero-colic circle" is produced by stimulating its automatic specialized peripheral *ganglia* (Auerbach's and Billroth-Meissner's) which dilates its arteries enticing hyperaemia engorgement for physiologic purposes (Sensation, absorption secretion peristalsis)—not merely tissue nourishment.

The *function* of the "entero-colic circle" is to engorge of its peripheral viscus (the transverse colon).

Anatomically, the "entero-colic circle" is a practical land mark for diagnostic and localization purposes.

The *utility* of the "entero colic circle" is as a typical *inosculation circle*, the object of which is to maintain maximum hyperaemia of its peripheral viscus (transverse colon) for functional objects (sensation, secretion, absorption) and to transport blood volume from one viscus (enteron) to another (colon).

The inosculation circle maintains maximum hyperaemia in its peripheral viscus with maximum collateral circulation.

Visceral drainage in the "enterocolic circle" produces maximum blood volume with maximum visceral elimination.

VI. THE "STRAIGHT TERMINAL VESSEL" OF THE INTESTINE.

(*Vas intestini terminale rectum.*)

"Straight terminal vessels" of the intestine or vas intestini terminale rectum extend from the mesenteronic or mesocolic arch to the border of the Enteron or colon.

The *dimension* of the "Straight terminal vessel" may measure ½ to 2 inches in the length. They are *located* between the blades of the mesentery, straight, extended parallel to each other, the enteron possessing perchance 6 to the inch and the colon numbering 4 to the inch. The "straight terminal vessel" is a constant structure belonging to the entire gastro intestinal tract. It is modified by environments of the 3 gastro-intestinal segments, gastrium, enteron, colon.

The "Straight vessel," is of ample length to be clamped or ligated without compromising the mesenteronic or mesocolic arch, (particularly the "enterocolic circle" arch—Riolan-Haller arch), and thus avoids jeopardizing the intestine to ulceration, gangrene. The "straight terminal vessel" originates from the convexity of the mesenteric or mesocolic arch and terminates by bifurcating at the mesenteric border of the intestine—chiefly, one branch coursing to the dorsal intestinal wall and the other to the ventral. The "Straight terminal vessel" is one of the most significant of vascular land marks of the intestinal tract and important of surgical guides.

The "straight terminal vessel" is of extreme practical importance, in intestinal surgery especially in intestinal resection. In gunshot wounds where the bullet severs the "straight vessel" at the intestinal border intestinal resection or appropriate, replicate suture is required to avoid intestinal ulceration or gangrene. The mesocolic "straight terminal vessel" is of two kinds, viz: (a) the long straight terminal vessel" which supplies the colon and an appendix epiploicus; (b) the "short straight, terminal vessel" which supplies the colon only. A mesocolic arch may lie in contact with the colon, on its internal or ventral surface, however, the "straight terminal vessel" exists and blunt dissection will expose with facility ample length (one to two inches) for clamping or ligating during intestinal resection. Among the chief factors of intestinal resection is the management of the blood supply, however the essential consideration is respect for the "straight terminal vessel" of the intestine. The *clinical* signification and *utility* of the "straight terminal vessel of the intestine is evident as a surgical guide. The appendicular artery is a straight terminal vessel of the "ileocolic circle" or the "ileocolic arches."

The *function* of the "straight terminal vessel" is to maintain a diffuse maximum blood volume to local areas for Physiologic purposes (sensation, secretion, absorption, peristalsis).

VII. APPENDICULAR ARTERY.

Arteria appendicularis—ramus appendicularis.

It is the "straight terminal vessel" of the "Ileocolic circle" or the "ileocolic arches."

Appendicular Artery. *Origin*:

The arteria appendicularis primarily and in the majority of subjects originates directly from the right circumference of the ileocolic circle (i. e., from the ileocolic artery in 96% of subjects).

The appendicular artery secondarily and in the minority of subjects originates directly from the "ileocolic arches," (i. e., from the combined anastomosis of the dorsal and central ileocoecal arteries in 95% of subjects).

The appendicular artery arises primarily from the "ileocolic circle" (96%) and secondarily and the "ileocolic arches" (95%).

The arteria appendicularis originates from the ramus colicus (of the illeocolic artery) in 3% of subjects.

The origin of the appendicular artery is from four sources, viz:

I. Trunk of ileocolic artery . . . 51% II. Ramus ileacus 45%	Ileocolic artery Right circumference of Ileocolic circle	. . . . . 96%
III. Ramus ileocoecalis dorsal . . 70% IV. Ramus ileocoecalis ventral...25%	Ileocoecal artery	. . . . . 95%
V. Ramus colicus	. . . . .	3%

Practically the appendicular artery arises from 3 sources, viz: (1) "Ileocolic circle" (96%) (2) "Ileocolic arches" (96%) (3) Ramus colicus (3%). The dorsal ileocoecal artery (70%) originates the appendicular artery 3 times more frequent than the ventral ileocoecal artery (25%).

Number. The maximum number of appendicular arteries in 65 consecutive subjects was 5. The minimum number was 1. The average number was 2.

In 65 subjects 33% possessed 1, 39% 2, 11%, 3, 3%, 4, and 2%,5 appendicular arteries.

Course. The appendicular artery in general courses from the right border of the "ileocolic circle" and "ileocolic arches" distalward and between the right mesocolic blades, dorsal to the distal ileum and terminates by coursing between the blades of the mesoappendix to end on the appendix.

The course of the principle appendicular artery determines the form of the meso-appendix. The appendicular artery coursed in every subject to the free end of the appendix and dorsal to ileum.

Dimensions. The length of the appendicular arteries vary from 2 to 7 inches, the diameter is markedly limited frequently thread like.

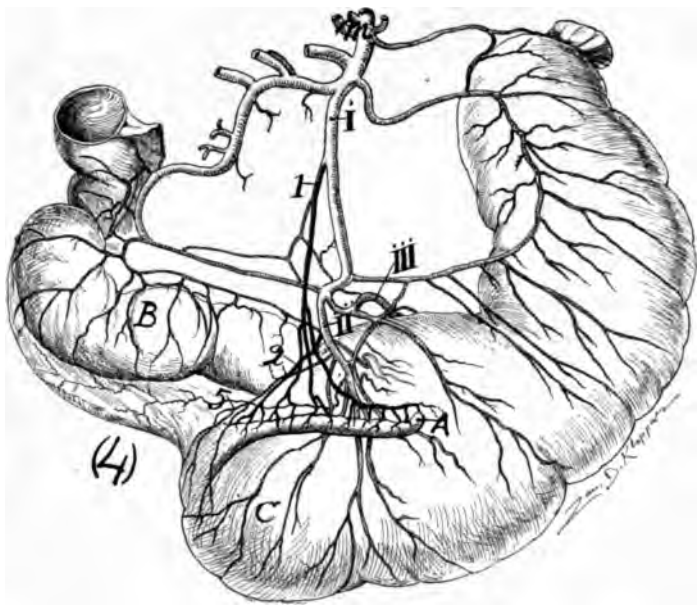
Practically the appendicular artery is the "straight terminal vessel" of the "ileocolic circle" or the "ileocolic arches."

Clinically the appendicular artery—a minimum artery—is significant as it nourishes the dangerous and treacherous, atrophic, appendix—dangerous because perityphlitis kills and treacherous because the capricious course of perityphlitis cannot be prognosed.

The general *aetiology* of perityphlitis is trauma of the psoas muscle producing perityphlitic peritoneal adhesions which by contraction compromise the appendicular vessels (especially in the meso-appendix) and flex the appendix checking drainage, ending in perforation. The main cause of perityphlitis is the compromising of the vessels in the meso appendix from mesoperityphlitis due to psoas muscular trauma. Trauma of the right psoas muscle induces infection to pass through the (appendicular, coecal or iliac) muscosa, through their muscularis and through their serosa, producing perivisceral peritoneal adhesions (adjacent to coecum and distal ileum.) in 70% of adult subjects, adjacent to the right psoas muscle. It is the meso-appendicular adhesions that produce the chief damage to the appendicular vessels by compromising their lumen diminishing blood volume to the appendix. Injections through the meso-appendix subsequent to meso-perityphlitis demonstrated that the meso-appendicular vessels were markedly defective, compromised in lumen.

(Trauma of the left psoas muscle produces 80% of mesosigmoiditis on the left).

The appendicular artery arises from the "ileocolic circle," in 96% of sub-



ARTERIA APPENDICULARIS.

Fig. 4. The specimen was injected, distended, dried and employed as a model by the artist, Zan D. Klopper. Dorsal view.

A, appendix, retro-coecal. B, ileum. C, coecum (nonsymmetrical). I., arteria ileo-colica. II., arteria ileo-coecalis dorsalis. III., arteria ileo-coecalis ventralis.

1, Arteria appendicularis (chief vessel) arises from the arteria ileo-colica (I.). 2, arteria appendicularis (2, secondary vessel) arises from the arteria ileo-coecalis dorsalis (II). The three appendicular arteries emit 15 branches. The main arteria appendicularis arises from the right circumference of the "ileo-colic circle" which is formed by the bifurcation of the jejunal artery into the ileo-colic and ileal arteries and their distal anastomosis. See section II., page 13.

The "ileo-colic arches," 6.

The "ileo-colic circle," the right circumference of which originates the main appendicular artery. See section II., page 13. Distended specimens appear to distort the blood apparatus. apparatus.

Appendix located retro-coecal.

jects, see figures, (21), (22), (23), (25), (33), (36), (37), (38), (43), (44), (47), (50), (51), (54), (56), (58), (59), (62), (65).

The appendicular artery arises from the "ileocolic arches" in 95% of subjects, see figures, (24), (30), (33), (36), (37), (38), (39), (40), (43), (45), (47), (50), (51), (54), (56), (58), (62), (65).

The appendicular artery arises from the ramus colicus (of the ileocolic artery) in 3% of subjects, see figures (26), (28), (42).

VIII. JEJUNAL ARTERY.

(Arteria Jejunalis).

I introduce the term *jejunal artery* as rational nomenclature and for the purpose of designating definitive segments of the proximal mesenteric artery. The jejunal artery extends from its origin in the aorta to the origin of the ileo colic artery.

The "*Jejunal artery*" or trunk of the proximal mesenteric artery averages 3 inches in length and 1/3 of an inch in diameter. *Location.* The jejunal artery extends from its origin on the ventral surface of the aorta, dorsal to the

pancreas and on a level with the 1st lumbar vertebra to its bifurcation in the arteria colica and arteria ilei, in the region of the origin of the distal mesenteric arterie. The trunk of the proximal mesenteric artery is identical with the jejunal artery and the ileal artery begins at the origin of the ileocolic artery. *Anatomically* the jejunal artery is an important land mark from its relation with the duodenum and aorta. It passes perpendicularly over the ventral surface in a groove of the duodenum in such a mechanical arrangement that the jejunum permanently occupies the limited jejuno-aortic angle.

The *functionation* of the jejunal artery is produced by stimulation of its *automatic* specialized peripheral *ganglia* (Auerbach's and Billroth-Meissner's) which dilate its peripheral vessels—engorging the 8 feet of jejunum with blood.

The *course* of the jejunal artery is practically parallel and ventral to the aorta. It emerges between the pancreas ventrally and duodenum dorsally, passing distalward between mesenteric blades to its bifurcation into the ileocolic and ileal arteries, forming the "ileocolic circle."

The *clinical* signification of the jejunal artery is of practical importance on account of the prevalence of *splanchnoptosia.*

The transverse duodenum lies in the aorta-jejunal angle, the diminution of which, during splanchnoptosia compromises the duodenal lumen—producing *gastro duodenal dilalation.*

The jejunal artery presents from its peculiar mechanical arrangement with the duodenum a most significant clinical feature from the fact that during the progress of splanchnoptosia, the jejunal artery clamps the transverse duodenum firmer and firmer, ending in gastro-duodenum dilatation. The jejunal artery must be inseparably, indelibly associated with compression of the transverse duodenum, during the progress of splanchnoptosia and consequent gastro-duodenal dilatation. The *utility* of the jejunal artery is that it emits transversely some half dozen powerful branches (rami-jejunales) to supply the 8 feet of jejunum tranporting sufficient blood volume to maximize digestion and minimize jejunal disease (e. g., tuberculosis and typhoid ulceration). Ample blood is a prophylactic and cure for disease and on account of abundant blood in the jejunum limited disease attacks it. The jejunal artery is a diagnostic and surgical guide to the point of obstruction in gastro-duodenal dilatation.

The jejunal artery emits the three colic arteries viz: (a) right colic. (b) transverse colic. (c) transverse colic accessory.

IX. "ILEAL ARTERY."

(Arteria Ilei).

I introduce the term *ileal artery* as rational nomenclature and for the purpose of designating, accurate, definitive segments of the proximal mesenteric artery.

The *"Ileal artery"* extends from the distal end of the jejunal artery or from the bifurcation of the jejunal artery to the distal inosculation with its opposite fellow, the ileocolic artery. The ileal artery forms the left circumference and the ileocolic artery forms the right circumference of the "ileocolic circle."

The mark of division between the jejunal artery and ileal artery is the emerging ileocolic artery.

Anatomically the ileal artery serves as the trunk for the emission of some 15 branches (remi ilei) to supply some 14 feet of ileum.

The *functionation* of the ileal artery is *produced* by the stimulation of the *automatic,* specialized, peripheral *ganglia* (Auerbach's and Billroth-Meissner's) which dilate its peripheral vessels engorging the 14 feet of ileum.

The ileal artery *courses* distalward between the mesenteric blades to the ileocolic region, inosculating with the ileocolic artery. Its *dimensions* are con-

siderably less than the jejunal artery. It averages 4 inches in length and at its proximal end is 1/4 inch in diameter.

Clinically the ileal artery is of significant importance on account of the prevalence of tuberculosis and typhoid ulceration in the distal ileum, or on the periphery of the ileal artery.

The ileal artery emits some 15 branches (rami-ilei) to nourish the 14 feet of ileum of such limited caliber (as compared with those of the jejunal artery) with consequent limited blood volume, especially at the distal ileum, that it is subject to ulceration and perforation (in typhoid fever and tuberculosis). Blood cures and is a prophylactic against disease. Hence the jejunum with its maximum calibered arteries and consequent maximum blood volume is not only the chief digestive segment of the tractus intestinalis but is rarely subject to disease (ulceration, or perforation).

The ileal artery is significant from the fact that it forms the left boundary of the "ileocolic circle." The stimulation of the automatic specialized, peripheral ganglia of which, (Auerbach's and Billroth-Meissner's) controls the caliber of the arteries composing the "ileocolic circle" and hence the blood volume of the ileum.

X. "DUODENAL CIRCLE."

(Arcus Duodenalis).

It is practically composed of the *Pancreatico-duodenal Artery.* (Arteria Pancreatico-duodenalis).

The pancreatico-duodenal artery consists of the proximal pancreatico-duodenal artery (arising from the right gastro-epiploic) and the distal pancreatico-duodenal artery (arising from the jejunal artery) solidly inosculated. The inosculation of the proximal and distal pancreatico-duodenal artery is so perfect solid and compact that no line of union, demarcation or anastomosis, can be located. Therefore I have named the proximal and distal pancreatico-duodenal arteries, the *"Pancreatico-duodenal artery"* as rational nomenclature and for the purpose of designating accurately a definitive segment of an artery, a distinct, indivisible arc or circle.

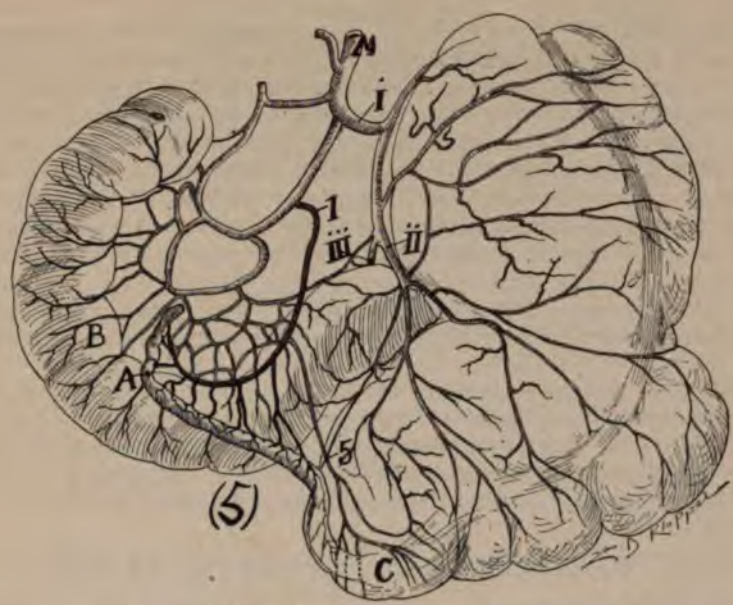
The "duodenal circle" is composed of the following segments, aorta and jejunal artery, the hepatic, gastro-epiploic and Pancreatico-duodenal arteries. Its circumference is composed of segments of 5 arteries (see figure (65)—). The *dimensions* of the Pancreatico-duodenal artery is some 5 inches in length and 1/12th of an inch in diameter.

The "duodenal circle" is solid and compact and a distinct vascular ring, arising adjacent to the right origin of the gastro-epiploic artery and terminating in the jejunal artery. The pancreatico duodenal artery frequently divides, bifurcates in its central segment forming an oval loop (surrounding the pancreatic head) which I term the *"Circle of the Pancreatico duodenal artery."* The "duodenal circle" solidly and compactly unites, anastomoses the duodenum (the most important intestinal segment) with the *"pancreatic circle"* and the blood volume of both circles are governed by similar automatic specialized peripheral *ganglia.*

The *clinical* significance of the "duodenal circle" is its intimate association with the duodenum, pancreatic head and ductus choledochus communis—all dignified organs in physiology.

The *utility* of the "duodenal circle" is its capacity to transport blood volume for functional purposes (sensation, secretion, absorption, peristalsis) from the coeliac axis (stomach) to jejunal artery (enteron) or vice versa.

The purpose of the "duodenal circle" an inosculation circle is to engorge to a maximum its peripheral viscus (duodenum and pancreas) and to transport



ARTERIA APPENDICULARIS.

Fig. 5. Specimen injected, distended, dried and drawn as a model by Zan D. Klopper. Dorsal view. A, appendix. B, ileum. C, coecum (symmetrical). M, arteria mesenterica proximal. I., arteria ileo-coecalis. II., arteria ileo-coecalis dorsalis. III., arteria ileo-coecalis ventralis. 1, Appendicular artery arises from the right border of the ileo-colic circle (or from a so-called mesenteric artery). The appendicular artery emits eight branches to the appendix. In its distributing branches it resembles that of the enteron or colon. No. 5 is the anastomosing branch between appendix and coecum. The blood-supply is arranged differently during the distended state than during the contracted state. Ileo-colic circle enclosed I. and III. while the appendicular artery courses through the circle. Ileo-colic arches, 3. The distention of dried specimens distorts the natural positions of the blood vessels. See section II., page 13. Appendix lies retro-ileac.

blood volume from one viscus (stomach, duodenum pancreas, liver) to an other (enteron).

The *utility* of the "duodenal circle" is Physiologic i. e., to maintain a continuous, maximum blood volume to the duodenum and pancreas with maximum collateral circulation. Maximum blood value in an inosculation circle produces maximum engorgement of its peripheral viscus and consequent maximum visceral elimination.

XI. "GASTRO ENTERONIC CIRCLE."

(Arcus gastricus Intestinalis).

Composed of the *"Duoednal Circle" and "Pancreatic Circle."* The combination "Duodenal Circle" and "Pancreatic Circle" forms the "Gastro-Enteronic Circle" (Arcus gastricus intestinalis).

The "duodenal circle" and "pancreatic circle" both serve the same purpose, i. e., the union or anastomosis of the coeliac axis (gastrium) with the jejunal artery (enteron), hence we propose the term, "gastro-enteronic circle" or arc. The duodenum and pancreas, two of the most siginficant abdominal viscera, are located in the periphery of the gastro-enteronic circle," which is governed by identical automatic specialized peripheral ganglia (Auerbach's and Billroth-Meissner's), hence both circles serve the same object, viz.: that of flooding the duodenum and pancreas with blood for physiologic or functionat-

ing purposes (sensation, secretion, absorption peristalsis). The duodenum and pancreas, both occupying dignified physiologic positions, during digestion, are necessarily organs requiring vast volumes of blood coursing rapidly through them—the utility of any organ being measured by the quantity of blood volume and rate of current. When food and fluid pass from the stomach into the duodenum the blood volume from the stomach, ("concentric gastric circles"), is transferred, directed toward the "duodenal circle" and "pancreatic circle," or in short toward the "gastro-enteronic circle" for the purpose of increasing the functions of the enteron and pancreas (sensation, secretion, absorption, peristalsis).

Inosculation circles ("gastro-enteronic circle") serve the purpose of directing the blood volume from one viscera to another for physiologic or functional purposes.

Clinically the "gastro-enteronic circle" is intimately associated with the stomach and liver the duadonum and pancreas, physioligic organs of a high order.

The *utility* of the "gastro-enteronic circle" is to connect solidly and compactly the gastrium (coeliac axis) with the enteron (jejunal artery) and to transport for physiologic purposes blood volume from the stomach to enteron and vice versa.

XII. PANCREATICO-COLIC OMENTAL ARTERY.

We will select as the most appropriate term, Arteria Pancreatica colica omentalis.

The arteria lienalis emits several arteries (1 to 4) which course always dorsal to the pancreas and pass over the distal pancreatic border to anastomose with the "Entero colic circle" rami omentales and to supply the colon.

The arteria pancreatica colica et omentalis is a component part of the "pancreatic circle" and supplies the transverse mescolon, transverse colon and omentum majus, aiding to anastomose solidly and compactly the arteries of the gastro-intestinal tract.

As examples of the *Arteria pancreatica colica omentalis* we present figures, (55), (56), (57), (58), (59).

Conclusions Regarding Inosculation Circles.

Blood cures disease.

Each cell lives and functionates in water. The apparatus of executing hyperaemia is the inosculating circle.

An "inosculation circle" consists anatomically of: (a) a vascular arc, (b), a peripheral viscus, (c), automatic specialized, peripheral ganglia.

The object of the "inosculation circle" is to engorge its peripheral viscus and transport blood from one viscus to another.

The means of functionating the inosculating circle is by stimulation of its automatic specialized peripheral ganglia.

Stimulation of the automatic specialized peripheral ganglia or any segment of the inosculating circle stimulated all the ganglia on the circle which dilates the caliber of all the vessel composing the circle—flooding the peripheral organ with blood.

The inosculating circle is the apparatus by which localized hyperaemia is secured for local, specialized, increase of common visceral function (sensation, secretion, peristalsis, absorption), and if it be the genital vascular circle, the special function of ovulation, menstruation and gestation is added.

The foetal ball, menstruation, ovulation, pubertas, copulation are the natural stimuli of the genital inosculating circle—"utero-ovarian circle."

Food, fluid, faeces, exercise are the natural stimuli of the "inosculation circles" of the tractus intestinalis ("concentric gastric circles," "ileocolic

circle," "ileocolic arches," "gastro enteronic circle," "Enerto-colic circle").

Therapeutic stimuli may be exercised with marked influence on the "inosculating circle" of the intestinal and genital tracts.

The solidity, compactness and freedom of anastomosis in every single visceral system (e. g., genital tract, gastro-intestinal tract, pulmonary tract, urinary tract) induces stimulation of any locality, to invite and maintain local hyperaemia.

The crux, the rock and base of circulation, is the anastomosis, or preferably the "inosculation circle."

The "inosculation circle" serves the purpose of transporting blood volume from one viscus to another for functional purposes e. g., food in the enteron, will entice blood from the stomach through the "gastro-enteronic circle."

The utility of any viscus is measured by the quantity and rate of its blood current i. e., the caliber of the artery composing the inosculating circle, determines the capacity of visceral function (e. g. the "genital vascular circle," the "concentric gastric circle," the "ileocolic circle").

Gestation in uterus or oviduct (stimulating the automatic, specialized, peripheral ganglia) concentrates, localizes, persistent hyperaemia, in the genital tract.

The automatic, specialized, peripheral ganglia on the "utero-ovarian circle" are genital ganglia, pelvic brain, etc., etc.

The natural means of stimulating the automatic specialized genital peripheral ganglia on the "utero-ovarian circle" is by pubertas, ovulation, menstruation, gestation, heat, massage, electricity, tampon, pessary, etc. etc.

It is by inducing a maximum normal volume of blood to flow through the utero-ovarian circle, the common visceral function (sensation, peristalsis, absorption, secretion) is increased and by special visceral function (e. g. ovulation, menstruation, gestation, the flow of blood through the utero-ovarian artery is markedly increased—perchance trebled during gestation).

Digestion of food or scybala in the gastro intestinal tract localizes, concentrates hyperæmia to increase localized common visceral function (sensation, secretion, persistalsis, absorption).

The automatic specialized, peripheral ganglia on the "concentric gastric circles, "ileocolic circle," "duodenal circle" "Pancreatic circle," "Gastro-enteronic circle," "Entero-colic circle," the duplicate bilateral, "Major mescolic circles," in short the arcus gastricus intestinalis, which is solidly and compactly anastomosed are Auerbach's and Billroth-Meissner's.

The means of stimulating the automatic, specialized, peripheral ganglia on the "gastro-intestinal circles" is by ample fluid and food administered at regular intervals—also heat, electricity, massage, exercise, environments, etc., etc.

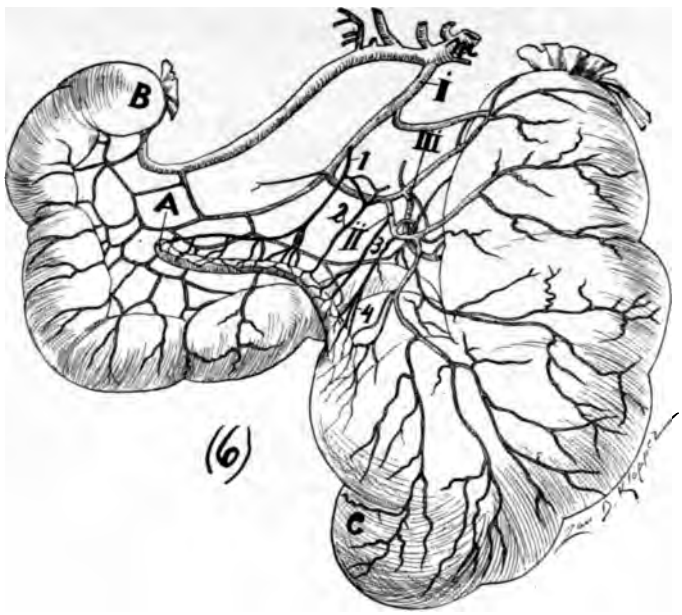
Fresh air in the lungs, (especially cold) induces hyperaemia of the "pulmonary circle"—which not only acts as a prophylactic, against disease but cures disease, e. g., tuberculosis.

The automatic, specialized, peripheral ganglia on the "pulmonary circle" are the pulmonary ganglia. The means of stimulating the automatic specialized peripheral pulmonary ganglia are by fresh air, (especially cold and exercise).

Ample fluids and diuretics induces local and general hyperaemia of the tractus urinaris, increasing the ureteral function (sensation, secretion, absorption, peristalsis), increases visceral elimination.

Ample visceral drainage increases volume and power of the ureteral current as well as attenuates urinal salts (deposits), hence visceral drainage is not only a prophylactic against the formation of ur[illegible]alculus, but it cures it, floating, dissolving transporting it toward

Three times recent[illegible] the ureter by



ARTERIA APPENDICULARIS.

Fig. 6. Specimen injected, distended, dried and employed as a model by Zan D. Klopper. Dorsal view.

M, arteria mesenterica proximal. I., arteria ileo-colica. II., arteria ileo-coecalis dorsalis. III., arteria ileo-coecalis ventralis. A, appendix. B, ileum. C. coecum (atrophic type).

1, Appendicular artery (chief vessel) arises from the right border of the "ileo-colic circle," i. e., the ileo-colic artery. 2, secondary appendicular artery arises from (1) and ileo-colic circle (i. e., right border of ileo-colic circle). 3 and 4 (tertiary and quartenary appendicular arteries) arises from the arteria ileo-coecalis dorsalis (II.). The 4 appendicular arteries emit 12 branches to the appendix.

"Ileo-colic circle" is formed by the bifurcation of the jejunal artery into the ileo-colic and ileal arteries and completed by their distal anastomosis.

"Ileo-colic arches" number 5, formed by the combined anastomosis of the arteria ileo-coecalis dorsalis et ventralis. Distention of the specimen distorted the arrangement of the blood apparatus.

The appendicular artery averages 2 for each individual.

The appendicular artery averages 2 either from the right border of the "ileo-colic circle" (i. e., the ileo-colic artery) or from the "ileo-colic arches" (i. e., the combined anastomosis of the dorsal and ventral ileo-coecal arteries. The old classification of the origin of the appendicular artery is artificial and useless.

The most practical method of finding the appendicular artery during removal of the appendix is to incise the meso-appendix when the chief source of blood will be evident from its spouting and that vessel should be ligated. The ligation of two appendicular arteries should be calculated in every appendectomy. The distal right "major mesocolic circle" is present. Appendix is located retro-ileac. See section II., page 13.

maximum Visceral drainage—by administering ample fluids at regular intervals—4 quarts daily.

A calculus in the ureter localizes ureteral hyperaemia, enables us to detect it from hyperaemia of the vesical ureteral orifice.

VISCERAL DRAINAGE stimulates the automatic specialized, peripheral ganglia of every "inosculation circle" by completely occupying the vascular tract with blood, distending it with fluid, so that maximum, normal, common function (sensation, absorption, peristalsis, secretion) may be capable of producing maximum normal visceral elimination. For a quarter of a century I have practiced what I term *Visceral Drainage*, (with regulation of diet) on the following plan of administering definite quantities of fluid (with urinary and

gastro-intestinal stimulants) 6 times daily. e. g. before meals and between meals.

The general directions for *visceral drainage* are:

BEFORE MEALS place together on the tongue 1/4 white* tablet and 1/2 brown* tablet and drink a glass full (8 ounces) of hot water. BETWEEN MEALS (that is at 10 A. M. and 3 P. M. and 9 P. M.) place on the tongue 1/4 white tablet with 1/2 brown tablet and drink a glass (8 ounces) of fluid.

The composition of the (white tablet) is sodium chloride, grains 12.

Composition of the (brown tablet) is the following:

Aloes Socatrine, 1/3 gr.

Ext. Cascara Sagrada, 1/40 gr.

Sodium bicarbonate, 1 gr.

Potassium bicarbonate, 1/3 gr.

Magnesium sulphate, 2 grs. •

CHAPTER I.

COELIAC AXIS.

(Arteria Coeliaca).

Synonyms.. Truncus coeliacus. Coeliac axis. Coeliac artery (this name was introduced by Jean Riolan, French anatomist, 1580-1657, professor in Paris). Abdominal visceral artery. Tripus coeliacus. Tripus Hallerii (Albertus von Haller, Swiss Anatomist and Physiologist, 1708-1777). Arteria opisto gastrica (Francois Chaussier, French Anatomist, 1746-1828). Eingeweide pulsader.

Dissection. Expose the abdominal viscera by a crucial incision of the abdominal wall force the liver proximalward and the stomach distalward. Divide the omentum minus which connects the liver and lesser gastric curature and search for the coeliac axis between the pillars of the diaphragm. Complete exposure of the coeliac axis requires the removal of the plexus coeliacus or abdominal brain.

Distribution. The branches of the coeliac artery supply the spleen, liver stomach, duodenum, pancreas, omentum majus.

Origin. It arises as an unpaired artery from the ventral surface of the aorta between the diaphragmatic pillars. It emerges from the aorta at the most proximal point of the hiatus aorticus.

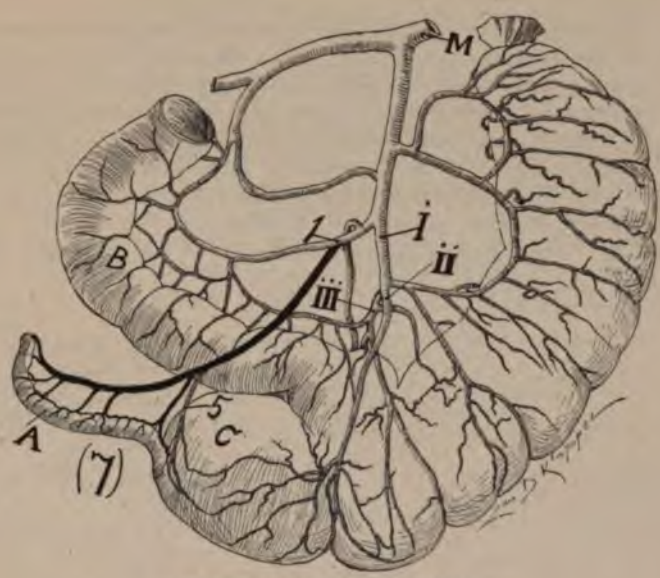
Location. It is located in the hiatus aorticus, between the pillar of the diaphragm on a level with the xiith dorsal vertebra. It is situated proximal to the pancreas and adjacent to the lobus Spigelii. It emerges from the aorta immediately distal to the phrenic arteries and one-half inch proximal to the origin of the jejunal artery (or the proximal mesenteric artery). Its position is on the right side of the cardia, and on the left side of Spiegel's lobe, dorsal to the amentu minus.

Dimension. Its length is one-half inch and diameter one-third of an inch. It possesses the maximum diameter and the minimum length of any abdominal visceral branch.

Course. Its course is directed ventralward at a right angle to the aorta. Its three main branches pass between the blades of the omentum minus. It course to the right of the cardia, to the left of Spiegel's lobe, and over the proximal border of the pancreas and along the left border of Spiegel's.

Relations. The most important relations of the coeliac artery is the intimately surrounding nerve sheath—plexus nervus coeliacus. The semilunar ganglia or the abdominal brain, are located bilaterally in contact with its wall. The solar plexus ensheaths the coeliac artery like a cylinder. The cerebrum abdominale solidly and compactly knit and bind in a composite unit by abundant powerful fibrous tissue, lymph channels, nerve strands, surrounds the celiac artery like a cuff. It is in relation with the lesser curvature of the stomach. The veliac artery is located between the arteriae phrenicae proximally and the jejunal artery (or the proximal mesenteric artery) distally.

Division. The *rule* of division of the arteria coeliaca is the arteria gastrica arises from the proximal surface of its trunk, whence later it bifurcates into its maximum branches, the arteria hepatica and arteria splenica. In infancy the arteria hepatica is the maximum branch of the trifurcation of the tripus Hallerii.



APPENDICULAR ARTERY.

Fig. 7. Arteria Appendicularis. Dorsal view.

Specimen, injected, distended, dried and employed as a model by Zan D. Klopper. A, appendix. B, ileum. C, cecum (symmetrical). M, arteria jejunalis. I., arteria ileo-cecalis. II., arteria ileo-cecalis dorsalis. III., arteria ileo-cecalis ventralis.

1, arteria appendicularis arises from the right circumference of the "ileo-colic circle." The large single appendicular artery emits seven branches to the appendix. The appendix is located parallel with the ileum. Practically each individual possesses two arteries.

"Ileo-colic circle," formed by the bifurcation of the jejunal artery into the ileo-colic and ileal arteries with their subsequent distalward anastomosis, contains three compartments, and the appendicular artery courses through its most distal compartment. The importance of the "ileo-colic circle" is that it originates the appendicular artery, and that it is a constant structure with a constant location. The "ileocolic circle" is a typical "inosculation circle" with peripheral automatic visceral ganglia.

I., arteria ileo-colica. II., arteria ileo-cecalis dorsalis. III., arteria ileo-cecalis ventralis. M, arteria jejunalis.

The distal right "major mesocolic circle" is present. It contains I. and II. There is one "ileo-colic arch."

The powerful, appendicular artery with maximum diameter is difficult to compromise by meso-appendicitis which leads to perityphlitis. See section II., page 13.

Variations of divisions (occuring in our 75 dissections). 1, The arteria gastrica emerges from the trunk of the coeliae axis which subsequently bifurcates into the arteria hepatica et arteria lienalis (the rule) (See figs. (40), (43), (53), (54), (55), (56), (57), (58)—). 2, It trifurcates into its three primary branches hepatic, splenic, gastric. See (figures (30), (37), (39), (41), (42), (44), (45), (46), (47), (50), (51)—). 3, It bifurcates and the splenic artery emits the gastric artery (33), (25), (38) or the hepatic emits the gastric artery (44). The coeliac artery may emit a branch to the jejunal artery, see (figures (38), (41), (43), (46), (50), (51)—). It may emit a branch to the Riolan-Haller arch, see (figure (30)—).

The *signification* of the arteria coeliaca is that it is one of the most important of the abdominal visceral arteries Of the three arteries supplying the tractus intestinalis it is the most ancient, the most proximal in location and possesses the maximum diameter. Its branches are subject to aneuraysm. The hepatic branch is subject to age relations and its marked diameter accounts for the marked dimension of the liver in early infancy. Clinically, the coeliac artery

is significant on account of its intimate relation to dignified organs as abdominal brain, stomach, duodenum, liver, spleen. The pulsation of the coeliac axis and its branches (particularly the gastroepiploic artery) is remarkable for its vigor immediately subsequent to meals. The stimulation of the specialized peripheral ganglia of the "concentric gastric circles" (Auerbach's and Billroth-Meissner's) entices large volumes of blood (hyperaemia, engorgement) flooding the stomach with blood for physiologic purposes hence the marked beating, pulsations observed in the gastric regions subsequent to meals.

The following table presents a bird's eye view of the branches of the arteria coeliaca.

AXIS.	I. Arteria hepatica communis ..	Arteria gastro-epiploica	rami pylorici proximal et distal. rami pancreatici. rami duodenalis proximal. arteria pancreatico duodenalis dorsal et ventral. rami gastrici dorsal et ventral. rami epiploici (distal concentric gastric circle).
		Arteria hepatica propria	ramus hepaticus dextra. ramus hepaticus media. ramus hepaticus sinistra. arteria gastrica (dextra). arteria cystica { ramus proximal. ramus distal.
COELIAC	II.	Arteria lienalis. . .	arteria pancreaticæ arteria gastrici breves. arteria gastro-epiploica (sinistra). rami proprii lienis. arteria pancreatica colica omentalis
	III.	Arteria gastrica . .	ramus œsophagei. ramus hepaticus. rami gastrici ventral et dorsal. rami pylorici (proximal concentric gastric circle)

SPLENIC ARTERY.

(Arteria Splenica).

The splenic artery is one of the leftward trifurcating branches of the coeliac axis of which it is the largest. It not only transports blood to the spleen for nutritional purposes but for other objects.

The splenic artery begins at the coeliac axis and ends at the spleen. The splenic is an unpaired artery and remarkable for its liberal diameter and spirality. Most splenic arteries are spiral, tortuous, others are practically extended or straight. Why exists spirality or tortuosity of the splenic artery? (and others). Is it to accommodate the variations in the dimensions of the spleen? Is it to retard blood volume to the spleen? The caliber of the splenic artery accords with the dimensions of the spleen. If the spleen be hypertrophied

the splenic artery is hypertrophied. If the spleen be atrophied the splenic artery is atrophied.

The law which governs arterial spirality or tortuosity is not exposed. However, corrosian anatomy practically demonstrates that all arteries are spiral or tortuous. I found that ureters not infrequently existed in a spiral state of 1½ rotations. Perhaps spirality or tortuousity is an original characteristic of corporeal tubes, (arteries, veins, ducts). Some arteries from peculiarly marked characteristic function retain marked spirality or tortuosity, e. g. Arteria, splenica, Arteria Uterina ovarica, Arteria gastrica, Arterica gastro epiplioica, Arteria coronoria cordis, Arteria Thyroidea, Arteria Externa maxillaris.

Synonyms Arteria Splenica, Splenic artery, Arteria lienalis. Left branch of coeliac axis.

Milzpulsader, milzarteria, Artere splenique.

The TOPOGRAPHY of the splenic artery may be condensed in the four following propositions, viz:

P. *Holotopy* (relation to general body). The splenic artery is located unilateral in the central portion of the trunk.

P. *Skeletopy* (relation to osseous skeleton). The splenic artery is related with the XII. dorsal vertebrae as well as the IX. and XII. ribs.

P. *Syntopy* (relation to adjacent organs). The splenic artery is associated with the proximal border of the pancreas, the dorsal border of the stomach, the liver and spleen.

P. *Idiotopy* (relation of component segments). The spiral segments of the splenic artery are continuous, in a horozantal direction. The diameter of the segments of the splenic artery gradually diminish from origin to termination.

Distribution. The splenic artery is distributed (1st) to the *pancreas* (rami pancreatici) (2nd). to the stomach (rami gastrici, vasa brevia) (3rd). to the *spleen* (rami splenici) (4th). to the *omentum majus* (rami epiploici).

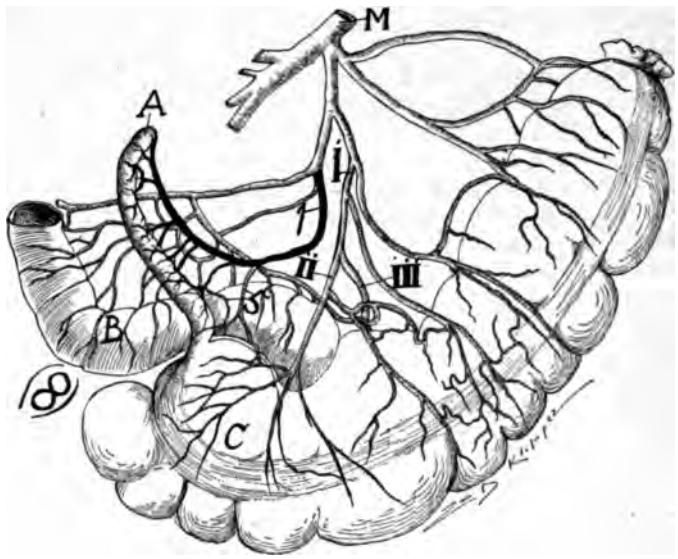
Origin. As a rule the splenic artery is one of the bifurcating branches of the coeliac axis. The usual condition is that 1st. the coeliac axis bifurcates forming a smaller branch—the gastric artery—and a larger branch—the continuation of the coeliac trunk. 2nd. the coeliac trunk rebifurcates forming a smaller branch—the hepatic artery and a larger branch—the splenic artery. The gastric artery frequently arises at a right angle from the coelia axis. The splenic and hepatic bifurcating at an abtuse angle.

Course. It courses spiral from right to left transversely over the left crus of the diaphragm parallel to the proximal border of the pancreas dorsal to the left end of the stomach and lesser sac of the peritoneum. It may lodge in a special groove on dorsal surface of the pancreas. In its course it lies ventral to the left adrenal, and proximal venal pole and passes between the two layers of the ligamentum gastro lienale where it divides into 4 to 7 terminal branches (rami lienales) which enter the hilum of the spleen. To supply the splenic parenchyma the splenic artery is accompanied by a fenestrated membraneous sheath of nerves and by the splenic vein which lies along its distal border. The terminal branches after entering the splenic hilum penetrate the spleen separately. Occasionally one terminal branch becomes oddly detached from the others and passes to supply the proximal or distal pole of the spleen. The splenic artery may be so spiral, tortuous or serpentine in its course that at local points a complete spiral circle may be formed

Branches of the Splenic Artery.

The splenic artery emits four sets of branches, viz; to the spleen, to the pancreas, stomach and omentum majus.

1. Rami Pancreatici, Arteria Pancreatica (media et Sinistri) or Pancreaticae Parvae are numerous large and small arteries, irregular in number



APPENDICULAR ARTERY.

Fig. 8. Appendicular Artery. Dorsal view.

Specimen injected, distended. dried and employed as a model by Zan D. Klopper.. A, appendix. B, ileum. C, cecum (non-symmetrical). I., arteria ileo-colica. II., arteria ileo-cecalis dorsalis. III., arteria ileo-cecalis ventralis. M, arteria mesenterica proximal.

1, arteria appendicularis, a single vessel of considerable dimension, arises from the right circumference of the "ileo-colic circle" or from a cross-bar of the circle. The appendicular arteries emits nine branches to the appendix.

Ileo-colic arches are four in number. The distension of the specimen distorted the blood colic arteries and completed by their distal anastomosis; is crossed by the appendicular artery. The immortality of the ileo-colic circle is insured by being the origin of the appendicular artery.

"Ileo-colic circle" formed by the bifurcation of the jejunal artery into ileal and ileo-apparatus.

The right distal "major mesocolic circle" is present. The position of the appendix is retro ileac.

A single appendicular artery of maximum diameter is the safest because it is not compromised with such facility by meso-perityphlitis (meso-appendicitis). See section II., page 13, for further description.

and dimension, which pass from the distal border of the splenic artery vertically distalward to the body and tail of the pancreas. They are the middle and left pancreatic arteries. Some of the pancreatic arteries are relatively large for the dimension of the pancreas. They form a solid and compact anastomatic network in the pancreas. The middle and left pancreatic arteries passing horizontally from left to right form an arch from the convexity of which pass dorsal and ventral branches to the pancreas.

2. *Pancreatica Magna* (P. M. in illustrations) is the largest and longest of the pancreatic arteries. The Pancreatica magna generally enters the tail of the pancreas coursing within the pancreas from left to right slightly proximal and dorsal to the pancreatic duct, terminates by inosculating with the "duodenal circle" and frequently also with the jejunal artery. The pancreatica magna is one of the main arteries which produce a solid and compact anastomosis between the coeliac axis (stomach) and the jejunal artery (enteron). I have termed the vascular anastomatic apparatus in the pancreas the "Pancreatic circle" or "arcus pancreaticus," see figures (45), (59), (47), (62), (64), (65), (48), (44), (56), (58), (51).

3. *Vasa Brevia* (Arteriae gastricae breves, fundi ventriculi, fundi gastrici) or short gastric branches, 4 to 6 in number are emitted from the splenic trunk or as terminal branches. They course between the blades of the gastro-splenic omentum to the major gastric curvature. They anastomose with the oesophogeal, gastric and epiploic branches. The vasa brevia may arise from the jejunel artery. See fig. (64).

4. *Arteria Gastro-epiploica sinistra* or left gastro epiploic artery arises from the splenic trunk or its terminal branches as a continuation of one of them. The left gastro-epiploic artery immediately after its origin emits branches to the cauda pancreatica, to the left end of the major gastric curvature and the omentum majus. The gastro-epiploic artery at its left end may emit some long slender rami, slightly branched to the omentum which anastomose with the colic arteries. These branches may be emitted from the splenic artery and pass distalward dorsal to the pancreas between the omentum blades to the transverse colon with the vessels of which they anastomose.

At some distance from the splenic fissure the splenic artery bifurcates or trifurcates which finally subdivide in 6 to 8 twigs, the twigs diverge at obtuse angles and penetrate the spleen at separate points along its fissure, occasionally one penetrates the spleen like a poniard external to the splenic fissure.

Arteria Pancreatica colica et epiploica (Omentalis).

An artery (or arteries) from the pancreatic supplies the transverse mesocolon and omentum majus. In dissection one finds a tendency for the splenic artery to unite with the colon. The omentum majus is supplied not only by branches from the gastro-epiploic artery (rami epiploici) but by several long, slender branches from the Arteria lienalis or from the "Pancreatic Circle." See figures (55), (56), (57), (58), (59).

For a year during frequent injection ever and anon I found an artery (1 to 4) extending from the arcus pancreaticus to the transverse colon and omentum majus. The peculiarity of this artery (or arteries) is that it courses always dorsal to the pancreas, (never ventral) and it may be traced (a), to inosculate with Riolan-Hallar arch (arcus mesocolicus or the enterocolic circle, (b) to supply the transverse colon, (c) to supply thhe omentum majus. Finally after searching some 100 anatomic text books without finding any reference to the arteria Pancreatica colica I found that Joseph Hyrtl in his *"Corrosion Anatomy"* (1873) had described the artery, (1 to 5) but had not named it. I named the vessel *Arteria Pancreatia Colica Omentalis.* I never found more than 4 of these long, almost non-spiral, slender, branchless, arteries which were mainly distributed to the transverse mesocolon, inosculated with Riolan-Haller arch, and secondly supplying the omentum majus. The arteria Pancreatica Colica an ostomore with the "Entero-colic Circle and rami-epiploici, and supply it colon. These arteries, so far as I could discover, practically arise from Arcus Pancreaticus, or the vascular anastomatic apparatus located within the pancreas and passed dorsal to the pancreas. Their original source may be considered from the splenic artery. However, practically the artery (or arteries) arise from the arcus pancreaticus or "pancreatic circle." They course at right angles over the distal border of the Pancreas. The middle artery possesses the greatest dimension.

Dimension. The diameter of the splenic artery is the greatest of any of the trifurcating coeliac axis (in adults). The splenic artery may attain a fourth of an inch in diameter. The length of the splenic artery is 6 inches.

General Remarks.

The splenic artery is the largest of the trifucating coeliac branches. It transports a colossal volume of blood.

It crosses the proximal pole of the left kidney and should be respected during renal operations. The splenic artery courses parallel and intimately adjacent to the proximal border of the pancreas and should be cautiously respected during operations on the spleen. To inspect the splenic artery during peritonotmy—incise the *omentum minus* or the *gastro-colic omentum*, or the *transverse mesocolon*. The splenic artery is the typical artery of the body for spirality. For richness and regularity the spirality of the splenic artery excells that of any other, even that of the uterine. The splenic artery possesses a marked age relation, not particularly as regards function (as is so phenomenal with the uterovarian artery) but as regards pathologic processes.

The remarkable spirality or tortuosity of the splenic artery of adults fails in children. The marked spirality of the splenic artery in adults depends to some extent on the degree of force employed during injection. Next to the aorta the splenic artery suffers the most frequently from atheroma and calcification. Phenomenally in advanced adult life and senescence the muscular and elastic tissue becomes degenerated. The elasticity and vital contractility of the artery is lost. The excessive coiling, spirality, and tortuosity of the splenic artery is a phase of adult life and senescence, atheroma, calcification, they are the inevitable accompaniments of diseased arterial walls. In infancy and adolescense the diameter of the walls of the splenic artery resemble those of any other artery of similar caliber. In advance adult life and senescence remarkable increase in the diameter of the wall of the splenic artery may be observed in autopsy.

In the parenchyma spirality of the splenic artery fails. The terminal splenic arteries pursue an extended course.

Clinically a remarkable phenomenon exists as regards the splenic artery. It is that if the spleen be removed, by ligating the arteries closely adjacent to the spleen subsequent hemorrhage is liable to arise. This occured repeatedly in my experiments in extirpating the spleen of dogs. Later I found that post operative hemorrhages could be avoided by ligating the splenic artery as closely adjacent to its origin in the coeliac axis as convenient. In searching the literature I found that the late distinguished Billroth was the first to suggest that to avoid post operative hemorrhages in splenectomy ligate the trunk of the splenic artery

Anomalies of the Splenic Artery.

The following anomalies of the spleenic artery occured in our personal dissection.

1. The splenic artery bifurcated abnormally adjacent to its origin from the coeliac axis. It emits an arteria splenica secunda. The secondary splenic artery may anastomose with the primary by means of tertiary branches forming vascular circles or islands. See figures (40), (43), (45), (49), (47), (48), (55), (60).

2. The splenic artery emitted a left gastric artery—ramas gastricus, see figures (40), (46), (51).

3. The splenic artery emitted a branch to the liver—ramus hepaticus.

4. The splenic artery emitted a branch (a) to the arcus colicus (Riolan-Haller arch) see figuers (40), (45), (56), (62), (58). (b) to the transverse colon see figures (59), (62), (58), (55), (c) to omentum majus see fig. (58), (55).

(The arteries (a), (b) and (c) may be called arteria transversa (media) by some writers).

6. The splenic artery emitted a branch to the arteria messenteric distal. See figures (42), (62).

7. The splenic artery emitted the gastro-epiploic artery. See figs. (38), (53), (56).

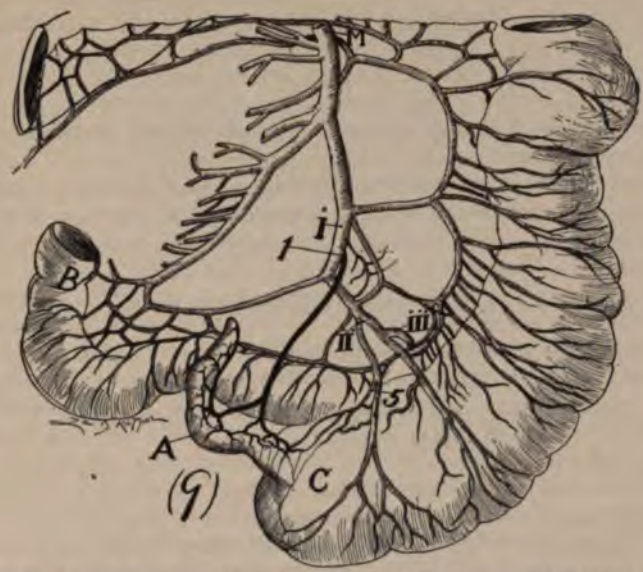


FIG. 9.—ARTERIA APPENDICULARIS, "ILEO-COLIC CIRCLE." "ILEO-COLIC ARCHES," "VAS INTESTINI TERMINALE RECTUM," "ILEAL ARTERY," DORSAL VIEW.

Specimen injected, dissected, dried and employed as a model by Zan D. Klopper. A, appendix. B, ileum. C, secum (non-symmetrical). I., arteria ileo-colica. II., arteria ileo-cecalis dorsalis. III., arteria ileo-cecalis ventralis. M, arteria jejunalis.

1, Arteria appendicularis, a single vessel of considerable dimension, arises from the right circumference of the "ileo-colic" circle," i. e., from the ileo-colic artery. The appendicular artery emits ten branches to the appendix. 5, the cecal branches anastomosing with the appendicular artery forming a vascular arch.

Ileo-colic circle (enclosing i and ii) formed by the bifurcation of the jejunal artery into the ileo-colic and ileal arteries and completed by the anastomosis of the distal ends. "Ileo-colic circle," a typical "inosculation circle," consists of a vascular arc, automatic specialized, peripheral ganglia and a peripheral viscus which the "circle" congests.

The "ileo-colic arches," five in number, formed by the combined anastomosis of the arteria ileo-cecalis dorsalis et ventralis. "Straight terminal vessel" of ample length (one-half to two inches) for clamping or ligating without compromising the meso-colic of mesenteronic arch. Ileal artery. In this figure I call atttention to the introduction of the term ileal artery form the left circumference of the ileo-colic circle.

The distal right "major circle" is present. The appendix is located retro-ileac. Straight terminal vessel presents ample length for ligature or clamp.

See section II., page 13.

HEPATIC ARTERY.

(Arteria Hepatica).

The hepatic artery is the rightward trifurcating branch of the coeliac axis, of which in adults it is the second in dimension. It is the nutritive vessel of the liver. In general the hepatic artery courses rightward ventral to the right crus of the diaphragm, inferior vena cava, the vena portae and adjacent to the left border of the ductus hepaticus. It is located in the dorsal cavity of the distal hepatic surface. On the arrival at the transverse hepatic fissure the artery trifurcates; the right branch supplies the right lobe, the left branch supplies the left lobe and its medial branch supplies the spigelian lol

During its course the hepatic artery emits [illegible] the pancreas (rami pancreatici); (2), th[illegible] the

duodenum (rami duodeni); (4), the gastrium (gastro-epiploica dextra-rami gastrici); (5), the liver (arteria hepatica propria); (6), the cholecyst (ramus cysticus).

Synonyms.—Arteria hepatica, hepatic artery, Leber arterie, Leber pulsader, arterie hepatique.

Origin.—The hepatic artery arises as one of the trifurcations of the coeliac axis.

Distribution.—It is distributed to the liver, gall bladder, duodenum, pancreas, stomach. The following table presents a bird's eye view of the hepatic trunk and branches:

II. Arteria hepatica propria
- (a) ramus hepaticus dexter—ramus cysticus { ramus proximal / ramus distal
- (b) ramus hepaticus media—
- (c) ramus hepaticus sinister—
- (d) arteria gastrica—dextra (rami gastrici) { dorsal / ventral
  (proximal gastric circle)

III. Arteria gastro epiploica (dextra) (distal gastric circle)
- (e) rami pylorici—
- (f) rami pancreatici—
- (g) rami duodenalis (proximal)
- (h) arteria pancreaticio duodenalis (dorsal et ventral)
- rami gastrici { dorsal / ventral
- rami epiploici

In this table the common trunk of the hepatic artery bifurcates into two principal branches (arteria hepatica propria and arteria gastro-epiploica (dextra) —) from which numerous branches arise; this plan of division simplifies the study of the hepatic artery. The hepatic artery possesses an age relation. In the new born the common trunk of the hepatic artery may equal in volume the combined splenic and gastric arteries. The arteria hepatica is the longest branch of the coeliac axis. (The large hepatic artery accounts for the voluminous liver in infancy.) The methods which I employed to expose the hepatic artery were: 1, dissection subsequent to injection; 2, the X-ray subsequent to metallic injection; 3, corrosion anatomy.

I. COMMON TRUNK OF HEPATIC ARTERY. (Arteria Hepatica Communis).

Origin.—Practically, the common trunk of the hepatic artery extends from the coeliac axis to the pylorus. It arises as one of the rightward directed bifurcation or trifurcation of the coeliac axis.

Termination.—It terminates at its point of bifurcation in the arteria hepatica propria and arteria gastro epiploica (dextra), i. e., practically dorsal to the pylorus and ventral to the vena portae. The portal vein separates the hepatic artery from Winslow's foramen. The bifurcation of the common trunk occurs immediately adjacent to the left border of the ductus choledochus communis.

Dimension.—The common trunk of the hepatic artery and the gastro-epiploic artery (dextra) averages 1½ inches in length and 1-5 inch in diameter. During intra-uterine life and infancy the hepatic trunk (and entire hepatic artery) is the maximum branch of the coeliac trifurcation. In adult life the artery is intermediate in dimension between the arteria gastrica and the arteria splenica.

Location.—The common trunk is located between the coeliac axis and the pylorus. It extends from the coeliac artery to the vena portae and the vena cava. It is situated dorsal to the minor gastric curve, ventral to the right diaphragmatic pillar, to the right of the cardia, left of Spiegel's lobe, and proximal to the

pancreas and splenic vein. The common trunk lies between the coeliac artery and the bifurcation of the arteria gastro-epiploica and the arteria hepatica propria.

Location of bifurcation of common trunk of the hepatic artery (propria) and the gastro-epiploic artery (dextra).—One and a half inches from the origin of the common trunk it bifurcates into the arteria hepatica propria and the arteria epiploica dextra, making arteries of practically equal volume, one attending the liver and the other the stomach, duodenum, and pancreas. (I discard the arteria gastro-duodenalis and replace it with the arteria gastro-epiploica dextra. This classification makes the arteria pancreatico-duodenalis simply a branch of the gastro-epiploica and simplifies the anatomy.)

Course and Relations. The artery courses from left to right slightly sinuous, in a horizontal direction, ventral to the right pillor of the diaphragm and between the blades of the omentum minus or ligamentum hepatico-duodenale to the region of the pylorus. It courses in the pancreatico-gastric fold. It assumes a curved course with the concavity directed proximalward to correspond to the distal border of the spigelian lobe. It courses adjacent to the splenic vein. The common trunk of the hepatic artery is in contact with the caput pancreatica distally and with the spigelian lobe proximally. At the beginning it lies on a plane dorsal to the portal vein, however, at the termination it courses ventral to the portal vein and ends adjacent to the left border of the ductus choledochus communis and on the ventral surface of the portal vein which separates it from the foramen of Winslow. Its course lies in the concavity of the distel hepatic surface. It courses dorsal to the lesser gastric curvature.

The proximal concavity of the common trunk of the hepatic artery is due to the moulding effect of Spiegel's lobe. Its bifurcated end lies ventral to the vena cava and vena portae.

Relations of the Trunk.

The common trunk is in relation dorsally with the right diaphragmatic pillar, the vena cava, and vena portae, with their accompanying nerves and lymphatics; ventrally with the dorsal parietal peritoneum, minor gastric concave curvature, peritoneum, omentum minus, and the distal surface of the liver; distally with the proximal border of the pancreas and the splenic vein; proximity with Spiegel's lobe. It is intimately connected with the nervus vasomotorius and lymphatics, woven into a neuro-vascular fibrous cylinder. It is profoundly intimate with the plexus coeliacus or abdominal brain.

Branches of the Common Trunk.—1. The most persistent is the hepatico-pancreatic branches, rami pancreatici (dextra), which pass from the distal border of the hepatic trunk and enters the parenchyma of the pancreas anastomosing with the pancreatic vascular net work, which I designate as Arcus pancreaticus, arch of the pancreas. (See Milwaukee Medical Journal for February, 1908.) The pancreatic branches, short, small, 1 to 3, are emitted from its common trunks of its hepatic artery mainly to the caput pancreaticus and collum pancreaticum where they compactly anastomos with numerous branches within the pancreas, arising from the arteria lienalis, proximal mesenteric and pancreatico-duodenal artery—constituting the anastomotic vascular apparatus of the pancreas or arcus pancreaticus. (See figures 46, 50, 56 and 57.)

2. The gastric artery (right) may originate from the common trunk at its right end. (See figures 46 and 56.)

Form.—It assumes with most of the abdominal visceral arteries a spiral and frequently sinuous state.

II. ARTERIA HEPATICA PROPRIA.

It consists of a short trunk of about an inch in length which originates: 1,

tude, that the left end is the origin, exactly similar to that of the arteria gastrica sinistra, exceeding that of the arteria gastrica sinistra.

Ramus Anastomoticus.

The Inosculation Branch.

By means of the ramus anastomoticus the inosculation of the right and left gastro-epiploic artery resembles that of a stove-pipe—no visible change in diameter or conjunction.

The ramus anastomoticus produces with the arteria epiploica dextra and sinistra a single, indivisible artery—the distal gastric vascular arch—the arteria gastro-epiploica. The left gastro-epiploic artery (ex-arteria splenica) solidly inosculates with the right gastro-epiploic artery (ex-arteria hepatica). It is the "greater concentric gastric circle."

Arteria Gastro-Epiploica—Gastro-Epiploic Artery.

"Distal Concentric Gastric Circle."

Synonyms. Arteria gastrica inferior. Arcus gastricus inferior. Arcus gastricus major. Arcus arteriosus gastricus inferior. Arteria coronaria ventriculi inferior. Arcus arteriosus gastricus major. Arteria gastrica ventriculi major. Arteria gastrica distal. Distal gastric artery. Magen-Netzpulsader. L'arteriae gastro-epiploique.

The gastro-epiploic artery is considered as a single indivisible vessel with a right origin from the hepatic and a left origin from the splenic artery. Since the arteria gastro-epiploica (sinistra et dextra) is compactly inosculated, it is a single indivisible artery and its branches will be known as emissions of the gastro-epiploic artery.

Distribution. The gastro-epiploic artery, or arteria gastro-epiploica, distributes branches to the stomach, pancreas, omentum majus, duodenum and colon transversum.

Branches. In its horizontal course the arteria gastro-epiploica emits numerous flexous branches from its proximal border to the dorsal and ventral surface of the greater gastric curvature. These branches, known as *ramvi gastrici,* dorsal et ventral, richly anastomose with the rami gastrici, dorsal et ventral, from the arteria gastrica. The arteria gastro-epiploica emits branches—epiploic arteries right, middle and left—arteriae epiploicae dextrae mediae et sinistrae) 6 to 10 (fig. 60) to the omentum majus from its distal horizontal border. These branches, long, slender and slightly sinuous, supplying the great omentum, known as rami epiploici, are of considerable length, diameter and solid anastomosis.

In the distalward course of the gastro-epiploic artery on the right side, it emits branches to the duodenum. The gastro-epiploic artery emits the *arteria pancreatico-duodenalis* (proximal) as it passes the distal border of the pylorus. The pancreatico-duodenal artery courses between the head of the pancreas and duodenum, emitting branches to both organs. The pancreatico-duodenal artery bifurcates, one branch passing on the ventral surface of the head of the pancreas to anastomose with the arteria pancreatico-duodenalis distal from the branches of the jejunal artery, the other coursing ventral to the head of the pancreas. The pancreas receives, also, a branch which traverses on its dorsal surface, anastomosing with the splenic and its branches. These three branches are of considerable dimensions, conducting a vigorous stream of blood.

In the distalward course of the gastro-epiploic artery on the left side, it may emit a branch to the pancreas. It not infrequently emits a large branch to the left border of the omentum majus. It may emit one of the vasa brevia. All the branches of the gastro-epiploic artery are solidly and compactly anas-

primarily dorsal to the ductus hepaticus communis and secondarily dorsal to the ductus choledochus communis. It lies ventral to the vena cava. It may lie ventral to the hepatic duct On arrival at the transverse hepatic fissure it divides into several branches which supply the parenchyma of the right liver lobe. The right hepatic branch is disturbed to the right lobe of the liver (and gall bladder) It divides mainly into two branches, viz., arteria hepatica dextra minor and arteria hepatica media (minor).

The arteria cholecystica, artery of the cholecyst or gall bladder, mainly arises from the ramus hepaticus dexter. It tranverses the gall bladder ventralwards mainly bifurcating into two branches, one on the free surface and the other on the border of the attached surface of the cholecyst. The arteria cystica may supply the parenchyma of the liver adjacent to fossa of gall bladder. The artery of the gall bladder chiefly arises from (a), the ramus hepaticus dexter (see figures 61, 53, 48 and 60), and divides into two branches to supply the gall bladder. One or more branches supply the cystic duct. The gall bladder artery also rises from (b) arteria pancreatico-duodenalis or ramus duodenalis (see figure 51). (c), From the arteria hepatica propria (see figure 56). The right artery of the liver originates chiefly in the artery of the cholecyst or gall bladder. Before it enters the transverse hepatic fissure the cholecystic artery bifurcates, one branch supply the distal and the other the left attached (proximal) lateral surface. Branches of the gall bladder artery may supply also the right lobe of the liver.

(3) Ramus Hepaticus Sinister. It courses ventral to the vena portae and dorsal or ventral to the ductus hepticus communis. It diverges from the ramus dexter at an acute angle. It passes to the left end of the transverse hepatic fissure, penetrating and supplying the parenchyma of the left lobe. The ramus hepaticus sinister originates chiefly the artery that supplies the spigelian lobe. Practically the arteria hepatica trifurcates into the ramus dexter, ramus sinister and ramus media (to supply the spigelian lobe).

The branch to Spiegel's lobe may arise from the right or left hepatic artery (see figures 60 and 63). It might be claimed that the arteria hepatica propria quadrifurcates, however, one of these branches may be assumed as a subordinate branch. The ramification of the hepatic artery with the liver I will present through X-ray labors. The illustrations of the distribution of the hepatic artery within the liver I prepared regardless of time and expense and they are presented with confidence in their accuracy. The branches of the hepatic artery accompany the branches of the portal vein.

The branches of the hepatic artery are less numerous than the branches of the hepatic duct and especially than the hepatic vein. The branches of the hepatic artery are not so sinuous as those of the portal vein. The arteria hepatica should be injected in situ, if one wishes to observe all the accessory hepatic arteries. The thoracic aorta is the most perfect or accurate route for the injection. The extra and intra hepatic ducts should be injected through the ductus choledochus communis. The vena portae should be injected in situ. The arteries, veins and ducts of the liver should be first injected separately and second the three channels should be injected in one liver to study the combined relations of vein, artery and duct. Dissection, X-ray and corrosion anatomy demonstrate three kinds of hepatic arteries.

(a.) First, there is the superficial one to the liver, ramus superficialis. The superficial hepatic artery supplies the connective tissue of the hepatic fissures, the perihepatic duct tissue and the superficial hepatic parenchyma immediately adjacent to the hepatic fissure. The superficial hepatic artery forms a solid anastomosis with its fellows Of the superficial artery several supply the ligamentum hepaticum branch and anastomose with the epigastric arteries. The superficial arteries supply the icus, ductus choledochus communis.

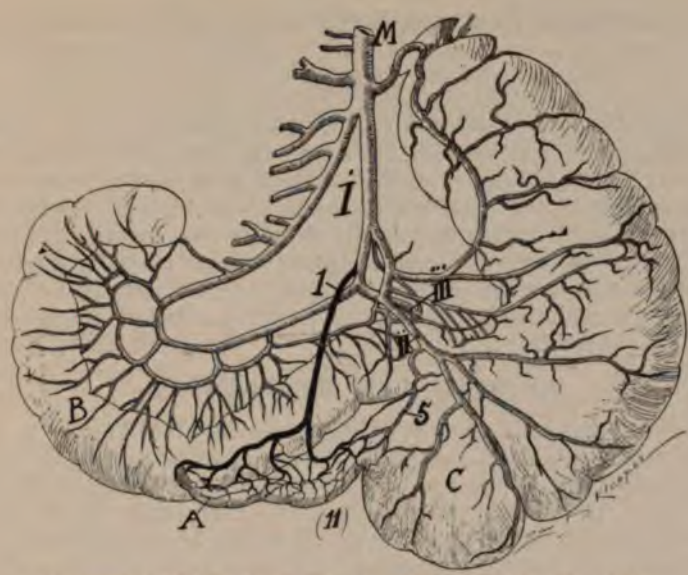
To the superficial arteries of the liver belongs the arteria cystica—the artery of the gall bladder. The artery of the gall bladder may not belong exclusively to the cholecyst, one of its branches frequently (strong) supplies the hepatic parenchyma in the cholecystic groove and port of the lobus quadratus.

(b.) Second, the parenchymatous hepatic artery which penetrates the substance of the liver and becomes located more adjacent to the distal (under) than the proximal (upper) surface. In other words, the parenchymatous arteries of the liver substance are located close to its distal surface. If a single artery of the hepatic parenchyma becomes injected a definite circumscribed hepatic area becomes supplied only. The parenchymatous arteries do not possess marked direct anastomosis. If accessory hepatic arteries be present as from the arteria gastrica and arteria jejunalis an injection in the accessory artery will be circumscribed definitely in the liver by said artery. Rami parenchymatosi or parenchymatosus arteries of the liver constitute the preponderating majority of the hepatic arteries. The parenchymatous arteries maintain a similar course to the branches of the portal vein and hepatic ducts. The parenchymatous arteries assume a spiral or sinuous course. The spirality is increased by increasing the pressure of injection. The spirality of the parenchymatous arteries also depends on the state of injection of the branches of the portal vein and hepatic ducts. If the portal vein be first well injected the parenchymatous arteries are relatively more spiral. If the hepatic ducts be first well injected the parenchymatous arteries are relatively more spiral. If the portal and hepatic ducts be first well injected the parenchymatous arteries are distinctly more spiral.

(c.) Third, the ramus perforans or perforating artery of the liver is the right and the markedly long left liver artery. The artery propria hepatica enters the right end of the transverse fissure and the ramus dexter requires but a short length to extend to the liver. The ramus dexter immediately after emitting the single or duplicate artera cystica bifurcates at right angles into a lesser ventral and larger dorsal branch. The ramus sinister requires greater length to extend to its destination in the lobus sinister. The ramus sinister courses leftward in a curved form branchless, for a considerable distance to the left end of the transdistal end of the parenchymatous artery which passes to the hepatic surface and anastomoses with its fellow forming a wide meshed network on the liver surface. The ramus perforans also supplies the hepatic peritoneum and hepatic ligaments. Practically the ramus perforans belongs to the ramus parenchymatosa forming two kinds of liver arteries, viz., divided in superficial and parenchymatous. The ramus dexter and sinister possess a slight degree of spirality. The ramus dexter and ramus sinister are sharply distinct or markedly differentiated from each other. The length differentiation is the markedly short verse fissure.

The caliber differentiation is that the ramus is over double the calibre of the ramus sinister. The ramus dexter supplies practically the lobus dexter, lobus quadratus and lobus spigelii. The ramus sinister supplies the lobus sinister (and may supply the lobus spigelii).

1. The division of the hepatic artery in the hepatic parenchyma possesses the peculiarity that its bifurcations seldom produce branches of equal caliber unless adjacent to the hepatic surface. The artery of the hepatic parenchyma emits numerous branches of limited dimensions and practically at right angles to the principal artery. The main branches of the arteria hepatica propria are distributed to the parenchyma of the liver. The terminal arterial hepatic branches accompany the corresponding branches of its vena portae and hepatic duct. The three structures (artery, vein duct) being enclosed in the capsule of Glisson become distributed throughout the substance of the liver (see figures



APPENDICULAR ARTERY AND "ILEOCOLIC CIRCLE."

Fig. 11. Appendicular Artery, Ileo-Colic Circle, Vas Intestini Terminale Rectum, Ileo-Colic Arches, "Major Mesocolic Circle." Dorsal view.

The specimen was injected, dissected, dried and employed by the artist, Zan D. Klopper, as a model. A, appendix. B. ileum. C, cecum (non-symmetrical). I, arteria ileo-colica. II., arteria ileo-cecalis dorsalis. III., arteria ileo-cecalis ventralis.

1, arteria appendicularis, a single vessel of considerable dimension, arises from the right circumference of the "ileo-colic circle" or the ileo-colic artery. The appendicular artery emits eleven branches to the appendix.

The "ileo colic circle" is composed of the ileal artery and the "ileo-colic circle" is composed of the ileal artery and the ileo-colic artery, is a constant structure and of significance as emitting the appendicular artery.

The "ileo-colic arches," four in number, consist of the combined anastomosis of the arteria ileo-cecalis dorsalis et ventralis. They richly supply the cecum, their primordial destination.

"Vas intestini terminale rectum" extending from the mesenteronic or meso-colic arches to the enteronic or colonic border, are of ample length (one-half to two inches) for ligation or clamping without compromising the mesenteronic or meso-colic arches.

The "ileal artery" extends from the bifurcation of the jejunal artery (into the ileo-colic and ileal arteries) to the distal anastomosis with the ileo-colic artery. The ileal artery emits branches to the ileum which is so the distal right "major mesocolic circle" is present —a constant structure in a constant location. Appendix located retro-ileac. For more complete explanation see section II., page 13.

— — —). The topography of the hepatic artery may be condensed in the following four paragraphs:

Holotopy.

Relation to the General Body.—The hepatic artery is located in the central right half of the trunk.

Skeletopy.

Relation to the Osseous System.—The hepatic artery is in relation with the right side of the XII dorsal vertebra and ribs.

Syntopy.

Relation to Adjacent Vescera.—It is in intimate relation with the right distal portion of the stomach, right end of the pancreas, liver, cholecyst, right crus of the diaphragm, foramen of Winslow, portal vein, ductus hepaticus, ductus

cysticus, oarta, inferior vena cava, omentum minus. It is located practically dorsal to the liver.

Idiotopy.

Relation of Component Segments.—The component parts of the hepatic artery are continuous, however, its different segments are of unequal volume.

The hepatic artery is important in the practice of medicine on account of its significant relations to the branches of the vena portae. The liver receives the venous blood from the tactus intestinals through the portal vein. During obstruction of the portal venous blood through the liver (hepatic cirrhosis, ascites, etc.) the physician is concerned with the problem of directing the portal venous blood through other channels than the liver. E. g., though the proximal portal veins to the proximal vena cava.

Anomalies of the Hepatic Artery.

The following anomalies arose in our personal dissection: 1, An hepatic artery arose from the gastric artery (or what may be designated the common trunk of it—(gastric and hepatic artery-gastro-hepatic artery). See figures 40, 45, 51 and 53). The arteria gastrica (sinistra) bifurcates in the lesser gastric curvature, one branch (arteria gastrica) of which inosculates with the arteria gastrica (dextra) to form the proximal gastric circle. This proximal gastric branch frequently divides to form a distinct vascular circle located along the lesser gastric curvature (I term this the "circle of the gastric artery," see figure 63). The other branch (gastro-hepatic), located in the omentum minus, courses to the left end of the fissura transversa hepatica to anastomose with a ramus superficialis of the ramus hepaticus sinistra and supply the left liver lobe, displacing the ramus sinister. When the gastro-hepatic artery exists the anomaly is constant.

An exception to this order exists in figure 51, in which there exists not only a partially duplicate proximal gastric artery, but the gastro-hepatic artery supplies the lobus hepaticus dextra. The circle of the gastric artery—half black —is evident in figure 51. The arteria gastrica hepatica is significant during gastrectomy on account of the location of the ligature. 2, An hepatic artery arose from the jejunal artery (proximal end of the proximal mesenteric artery), see figures 36 and 53, also X-ray illustration. This was a frequent occurence. 3, A distinct hepatic artery arose from the aorta. 4, The cystic artery arose from (a), the arcus duodenalis duodenal arch. (Figure 951). (b), From the trunk of the arteria hepatica propria (Figure 56). 5, An hepatic artery arose from the bifurcation of the arteria hepatica propria (see figures 49, 61, 56 and 63). 6, The arteria hepatica propria bifurcates from its origin, i. e., at the right end of the common trunk of the hepatic artery (see figuers 51, 56 and 60). 7, The ramus hepaticus coursed ventral (instead of dorsal) to the ductus hepaticus communis (or ductus choledochus communis) in 20 per cent of the subjects. (See figures 51 and 48.) 8, The ramus hepatica dexter emitted an arteria cystica accessoria. (See figure 60.) 9, The right gastric artery was duplicate in origin. (See figures 46 and 51.) 10, The ramus hepaticus sinister anastomosed with a ramus hepaticus or arteria gastric sinister), forming a complete vascular circle. (See figure 53.)

General Remarks on Anomalies of the Hepatic Artery.

The liver may be supplied, especially superficially, by small branches from (a), the abdominal aorta; (b) from the jejunal artery (proximal mesenteric); (c), arteria gastrica (sinistra); (d), arteria renalis dextra; (e), arteria suprarenalis dextra; (f), arteria spematica (ovarica) dextra; (g), arteria mammaria dextra; (i), arteria gastro-epiploica. If any of the above small arteries

become markedly enlarged or dilated they are called arteriae hepaticae accessoriae or accessory hepatic arteries.

The liver possesses an extensive blood supply from numerous sources. Some of the accessory hepatic arteries becoming enlarged may act vicariously for any failing regular hepatic artery (See report by Dr. C. H. McKenna, *Surgery, Gynecology and Obstetrics*, September, 1907. The accessory hepatic arteries are mainly associated with the superficial hepatic branch, ramus superficialis hepatis. The accessory liver arteries explain why the liver remains supplied with blood sufficient to exist subsequent to obstruction of the usual hepatic artery by neoplasm, embolus. The accessory hepatic arteries possess the capacity to experience marked dilation for the purpose of collateral circulation if required.

The greatest therapeutic problem is the local control of blood volume, for, it is blood that cures disease.

The rock and base through which circulation may be controlled is anastomosis. For example, the utero-ovarian artery or genital vascular circle represents the typical anastomosis where therapeutic has attained its maximum results in the control of blood volume. All observing gynecologists know that blood is the most significant agent in curing many genital diseases, especially those of an inflammatory type.

The automatic genital ganglia distributed along the utero-ovarian artery have been specialized for so many eons of ages that any stimulant to any segment of the utero-ovarian artery congests the genitals with blood (e. g., gestation, vaginal douche, electricity, stempessary massage, menstruation, tampon).

In the liver the control of blood volume has advanced to a marked therapeutic degree. The liver not only has the hepatic artery as a nutritive vessel, but receives also the blood from the intestinal tract through the portal vein.

The method by which the portal venous blood is directed to the heart without first passing through the liver is to transmit it by way of the proximal epigastric veins. The omentum majus is scarified and sutured to the ventral abdominal wall, whence the tributaries of the portal vein pass into the superficial epigastric veins and finally into the proximal vena cava and the right auricle.

The liver is the largest gland in the body and it may be hoped that therapeutic agents of coming time will control the blood supply.

At present by irritating the tractus intestinalis we can divert the blood volume from the liver to a marked degree.

III. Gastro-Epiploic Artery. (See page 51).

GASTRIC ARTERY.

(Arteria Gastrica.)

The Proximal "Concentric Gastric Circle."

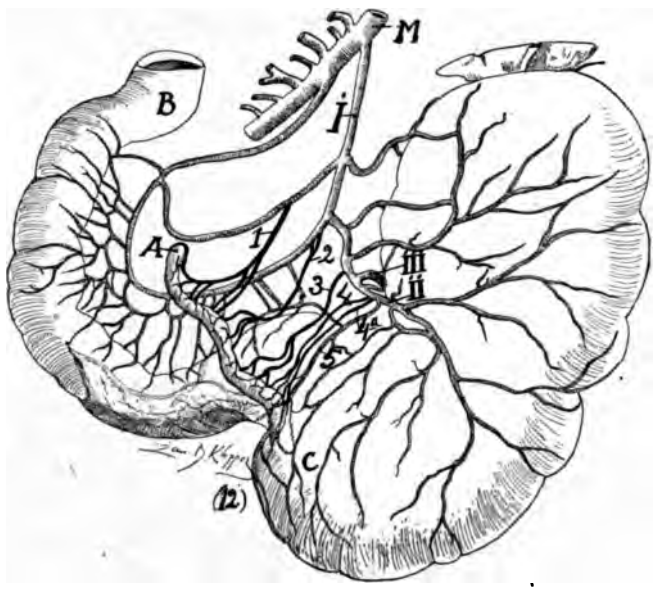
The gastric artery is one of the trifucating branches of the coeliac axis of which in adult it is the least in dimension. It is the nutritive vessel of the lesser gastric curvature in which it is located. The gastric artery is an arc with a left origin from the trunk of the coeliac and a right origin from the common trunk of the hepatic and gastro-epiploic arteries. Its circle is completed by the hepatic artery. The concavity of the gastritic artery curve is directed proximalward. It is an unpaired artery.

The TOPOGRAPHY of the gastric artery may be generalized in the following condensed statements.

Holotopically (relation to general body). The gastric artery is located symetrically in the central portion of the trunk.

Skeletopically (relation to osseous system). The gastric artery is related with the I. and II. lumbar and XII. dorsal vertebrae.

Syntopcally (relation to adjacent organs). The gastric artery is associated



ARTERIA APPENDICULARIS. "ILEO-COLIC CIRCLE," "ILEO-COLIC ARCHES," "STRAIGHT TERMINAL VESSEL," ILEAL ARTERY.

Fig. 12. I injected this specimen, dissected, died and employed it as a model for the artist, Zan D. Klopper. Dorsal view. A, appendix. B, ileum. C, coecum.

I., arteria ileo-colica. II., arteria ileo-coecalis dorsalis. III., arteria ileo-colica. 4 and 4a, arteria appendicularis (quartenary vessels) arise from the arteria ileo-coecalis dorsalis. The 5 appendicular arteries emit 16 branches to the appendix.

"Ileo-colic circle" is formed by the bifurcation of the jejunal artery into ileo-colic and ileal arteries and completed by their distal anastomosis. It is evident in this figure and divided by a crossbar artery. The free appendicuular end occupies the ileo-colic circle. The signification of the ileo-colic circle in this speimen is that it originates 2 out of 5 of the appendicular arteries and that it is an "inosculation circle" possessing automatic peripheral, specialized ganglia and a peripheral viscus (colon, coecum, appendix and ileum).

Ileo-colic arches number 4 and are composed of the combined anastomosis of the arteria ileo-coecalis dorsalis et ventralis. The "ileo-colic arches" is a primordial vascular landmark.

"Vas intestini terminal rectum" or "straight terminal vessel of the intestine" extending from the mesenteronic or mesocolic arches to the border of the mesenteron or the colon is of ample length (½ to 2 inches) for clamping or ligation without compromising the mesenteronic or mesocolic arches. The straight vessel is of practical importance in intestinal surgery.

Ileal artery extends from the bifurcation of the arteria jejunalis to its distal anastomosis with the ileo-colic artery. The ileal artery emits branches to the ileum which wholly supply the proximal end but sparely supply the distal end of the ileum. For more complete explanation see section II., page 13.

with the stomach, pancreas, liver, cholecyst, omentum minus splenic and hepatic arteries.

Idiotopically (relation of component segments). The gastric artery is an arc with its concavity presenting proximalward. Its right origin (ex arteria hepatic) is practically on a level with its left origin (ex arteria coelica). The gastric arch is located distal to its right origin but partly proximal to its left origin. The component segments of the gastric artery are continuous, however, irregular in diameter and course.

Note. I shall assume that the term arteria gastrica, is correct and that it should be described as a single indivisible artery similar to the utero-ovarian. The location of the inosculation of the right and left gastric artery cannot be

indicated or marked. For convenience of description the terms right origin, origo dextra and left origin, origo sinistra may be employed. It is true the gastric artery may vary in diameter in different segments, however, this fact does not furnish the clue to the point of inosculation. We shall assume as the correct terms arteria gastrica (dextra), right gastric artery and arteria gastrica (sinistra) left gastric artery.

I. Arteria Gastrica (Dextra).

Synonyms. Arteria pylorica. Arteria gastrica minor. Arteria, coronaria ventriculi dextra. Arteria gastrica superior dextra, right coronary artery, right gastric artery.

Die rechte obere Kranz Pulsader des magens.

Kleine oder rechte Kranze pulsader des magens

Artere gastrique droite.

Origin. The arteria gastrica dextra, or right gastric artery arises: (a), from the right branch of the arteria hepatica propria; (b), from the arteria hepatica communis; (c) from the left branch of the arteria hepatica propria; (d), from the arteria gastro-duodenalis; (e), from the common trunk of the arteria hepatica propria. The right gastric artery arises opposite the proximal border of the pyloris. See figures (30), (38), (40), (42), (43), (44), (45), (46), (47), (48), (49), (51), (53), (56), (57), (63).

Course. The course of the arteria gastrica dextra is first distalward toward the pylorus whence it directs itself leftward in a curved, sinuous journey between the blades of the omentum parallel and adjacent to the minor gastric curvature to inosculate with the arteria gastrica sinistra. The distance between the gastric artery and the lesser gastric curvature varies from contact to one inch. The direct course of the artery may be interrupted by deviating anastomses.

At the junction of the middle and right third of the lesser gastric curve the right gastric artery bifurcates forming the right half or portion of what I term the "*Circle of the gastric artery*" (Fig. (63)—) which is completed by the bifurcation of the left gastric artery.

Dimensions. It is 1/12 of an inch in diameter and its length cannot be measured as the arteria gastrica forms by inosculation one indivisible artery similar to the arteria uterina ovarica. Its diameter is greater at its origin than 4 inches leftward. It extends from the point of inosculation with the left gastric artery to the arteria hepatica propria. The root of the arteria gastrica dextra is of less dimension than that of the arteria gastrica sinistra.

Location. The arteria gastrica dextra is situated in the right end of the minor gastric curvature between the blades of the omentum minus.

II. Arteria Gastrica (Sinistra).

Synonyms. Arteria coronaria ventriculi sinistra. Arteria gastrica superior sinistra. Arteria coronaria ventriculi superior. Gastro-hepatic artery. Arteria gastrica major, left coronary artery. Arteria gastrica magna, left gastric artery.

Linke obere Kranz Pulsader des magens.

Grosse obere magen Kranz Gefasse.

Artere Gastrique gauche.

Origin. It arises: 1st, as a rule from the proximal surface of the trunk of the coeliac artery between its origin and bifurcation into hepatic and splenic arteries. 2nd, it may arise from the arteria splenica or 3rd, from the arteria hepatic communis.

Course. It courses proximalward, ventralward and leftward over the left crus of the diaphragm in a special fold of peritneum to the cardiac orifice of

curved course, distalward, rightward, parallel, to the lesser curvature of the the stomach, to supply the cardia whence it directs itself by an acute angle in a stomach between the blades of the omentum minus in the gastro-pancreatic fold to inosculate with the arteria gastrica dextra (ex arteria hepatica). It pursues a semicircular, sinuous course between the blades of the onentum minus. In the beginning of its course it lies dorsal to the onetum minus. The course of the artery varies considerably as to its distance from the lesser gastric curvature. The course of the gastric artery may not only present sinuosity but angularity.

In its course adjacent to the junction of the left with the middle third of the lesser gastric curve it bifurcates, forming the left half or portion of what I call the "Circle of the gastric artery" (See figure (63) —) which is completed by the bifurcation of the right gastric artery.

In short the middle third of the gastric artery bifurcates, forming a vascular circle—"Circle of the gastric artery." The bifurcation of the left gastric artery presents frequently two arteries of equal volume coursing practically parallel to the distal third of the lesser curvature.

The "circle of the gastric artery" may be of considerable dimensions—e. g. 4 inches in length by one inch in diamater and of oval form.

Location. 1st. Dorsal to the omentum minus. 2nd, within the gastro pancreatic fold and between the minor omental blades. It is located in the lesser gastric curvature.

Dimension. The arteria gastrica sinistra is about 1 6 of an inch in diameter at its origin at the coeliac axis. It possesses the minimum dimension of the three coeliac branches and gradually diminishes toward the middle of the lesser curvature. The inosculation of the (right and left) gastric artery might be considered to occur at the middle of the lesser gastric curve where the arteries are the most diminutive in diameter. Its length cannot be designated as the point of its inosculation with the arteria gastrica dextra cannot be located—it may measure 10 inches in length.

Ramus Anastomoticus.

The Inosculation of Right and Left Gastric Arteries.

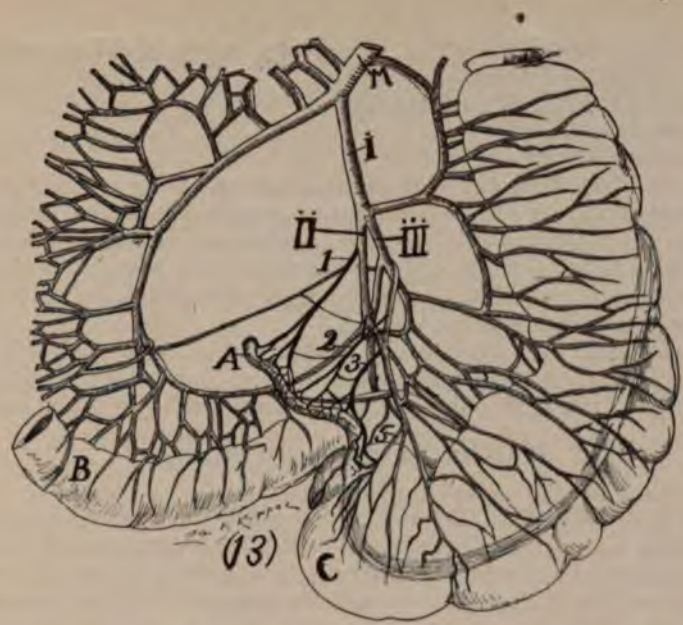
Ramus anastomoticus is the means by which the arteria gastrica dextra et sinistra become solidly inosculated. The right gastric artery (ex arteria hepatica) forming a single indivisible, continuous vessel—the proximal gastric vascular arch. The ramus anastomoticus unites the right and left gastric artery producing the "proximal concentric gastric circle." Since the gastric, right and left forms by inosculation a single, indivisible, continuous vessel similar to the arteria uterina ovarica, all its branches will be known as branches of the gastric artery. Frequently the gastric artery courses as a double practically parallel vessel of almost equal volume for 1 3 to $\frac{1}{2}$ its length in its middle portion and these two branches may inosculate forming a distinct vascular circle of considerable magnitude located in the lesser gastric curature—"Circle of the gastric artery."

THE GASTRIC ARTERY. (Arteria Gastrica).

The "Proximal Concentric Gastric Circle."

Synonyms of (The Gastric Artery.)

Proximal gastric circle. Arteria, gastricasuperior. Arcus gastricus proximal. Arcus gastricus minor. Arcus arteriosus proximal. Arcus arteriosus gastricus minor. Arteria coronaria ventriculi. Arteria coronaria ventriculi proximal. Arteria coronaria ventriculi superior. Arteria coronaria ventricu-



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE," "ILEOCOLIC ARCHES." VAS INTESTINI TERMINALE RECTUM. ILEAL ARTERY. RIGHT DISTAL. "MAJOR MESOCOLIC CIRCLES."

Fig. 13. Specimen injected, dissected, dried and employed as a specimen by the artist, Zan D. Klopper. Dorsal view. A, appendix. D, ileum C, cecum. I., arteria ileo-colica. II., arteria ileocoecalis dorsalis. II., arteria ileocoecalis ventralis.

1, Arteria appendicularis (primary vessel) arises from the right border of the ileocolic circle, i. e., from the ileocoecalis dorsalis. 2, arteria appendicularis (secondary vessel) arises from the right border of the ileocolic circle, i. e., from both dorsal and ventral arteria ileocoecalis. 3, arteria appendicularis (tertiary vessel) arises from the arteria ileocoecalis dorsalis. Observe that the 2nd and 3rd appendicular arteries forms an anastomosing loop simulating a mesenteric arch. 5, is the anastomotic branch between the cecum and appendix. The 3 appendicular branches emit 16 branches to the appendix.

"Ileocolic circle" is formed by the bifurcation of the arteria mesenterica proximal into the ileocolic and ileal arteries and completed by their distal anastomosis. The signification of the ileocolic circle is that it generally emits the arteria appendicularis which immortalizes it among vascular circles. It is a constant structure located in the ileo-colic angle. The ileo-colic circle is evident in this specimen. It is divided by a cross bar artery. Its signification is that it originates two of the three appendicular arteries. There is a tendency in the development and differentiation of viscera to form the "inosculation circle."

The ileocolic arches number 8 and are composed of the combined anastomosis of the arteria ileo-coecalis dorsalis et ventralis. . . The "ileocolic arches" are a primordial vascular landmark. They are located in the ileocolic angle and attend the cecum.

"Vas intestini terminale rectum" or "straight terminal vesssel of the intestine" extending from the mesenteronic or mesocolic arches to the border of the mesenteron or the colon is of ample length (½ to 2 inches) for clamping or ligation without compromising the mesenteronic or mesocolic arches. The straight vessel is of practical importance in intestinal surgery. In the mesenteron there is perhaps six "straight vessels" to the inch. In the mesocolon there are four "straight terminal vessels" to the inch. The mesocolic "straight terminal vessel" is of two kinds, viz: (a), the "long straight terminal vessel" which attends the colon and an appendix epiploicus; (b), the "short straight terminal vessel" which supplies the colon only.

The ileal artery extends from the bifurcation of the arteria mesenterica proximal to its distal anastomosis with the ileocolic artery. . . The ileal artery emits branches to the ilcum which is so limited in blood supply at its distal end that is it liable to ulceration and perforation especially in typhod fever or tuberculosis. The ileal artery forns the left circumference and the ileocolic artery the right circumference of the ileocolic circle.. Right distal "major mesocolic circle" present. For further explanation see section II, page 13.

The "concentric gastric circles"—marked in black—are plainly visible with gastrium reflected proximalward or in situ.

The "concentric gastric circles" are of practical interest in surgical procedure on the stomach. They are of vastly more practical interest than the circle of Willis, which has maintained its undisputed swa yfor two and a quarter centuries.

The stomach practically lies between the "concentric gastric circles," i. e., the gastric artery proximally and the gastro-epiploic artery distally, and in performing gastrectomy a ligature is required at the right and left end of the gastric artery and also at the right and left end of the gastro-epiploic artery. In ligature of the gastric artery, it is practical to attempt to determine if a ramus hepaticus exist which should not be ligated.

THE "DUODENAL CIRCLE," "ARCUS DUODENALIS."

Arteria Pancreatico-duodenalis Proximal. Arteria Pancreatico-duodenalis distal.

The *"duodenal circle"* or duodenal arc connects the hepatic artery with the jejunal artery. It is solidly and compactly anastomosed with the "Pancreatic Circle." The "duodenal circle" is composed by the solid and compact inosculation of the arteria Pancreatico-duodenalis proximal (superior) with the arteria pancreatico-duodenalis distal (inferior).

A. ARTERIA PANCREATICO-DUODENALIS PROXIMAL.

The Proximal (Superior) Pancreatico-Duodenal Artery.

The Major Pancreatico Duodenal Artery.

Origin. The proximal pancreatico-duodenal artery arises from the right gastro-epiploic artery dorsal to the pylorus. It originates from the gastro-epiploica dextra on a level with the proximal border of the pancreas.

The proximal pancreatico duodenal artery may possess two origins, one from the right gastro-epiploica and the other from the varied sources—the hepatica propria, right gastric epiploica, the aorta, see figures (30), (38), (39), (43), (44), (45), (46), (51), (56), (57), (62). The proximal pancreatico-duodenal artery may arise as one artery and shortly bifurcate—one branch coursing ventral and the other coursing dorsal to the duodenum, see figures (33), (40), (42), (47), (59), (64).

Course. The proximal pancreatico-duodenal artery courses distalward and leftward in the concavity of the duodenum between the duodenum and head of the pancreas, whence it inosculates with the distal pancreatico duodenal artery.

Dimension. The proximal pancreatico duodenalis is an artery of equal or perchance less dimension than that of the right gastro-epiploica. It possesses a diameter of perhaps 1/10 or 1/12 of an inch and its length cannot be measured as its point of inosculation with the distal pancreatico-duodenalis is invisible.

The proximal pancreatico duodenal artery is of greater dimensions than that of the distal.

B. ARTERIA PANCREATICO-DUODENALIS DISTAL.

The Distal (Inferior) Pancreatico Duodenal Artery.

The minor Pancreatico-duodenal artery.

Origin. The distal pancreatico duodenal artery arises singly from the right side of the jejunal artery, see figures (48), (53), (59), (61), (64). It may possess a double origin from the jejunal artery, see figures (25), (30), (38), (39), (40), (41), (43), (44), (45), (47), (51). It may possess a treble origin,

branches to the proximal and distal surface of the pylorus. The pyloric branches anastomose with the branches of the arteria gastro epiploica dextra.

(5). *Arteria diaphragmatica,* may be emitted from the gastric artery. It supplies mainly the diaphragm and adrenal of its corresponding side.

"The Concentric Gastric Circles."

If the abdominal aorta is completely injected with red lead and starch and the celiac axis with its trifurcated branches isolated by dssecton, two concentric gastric circles are visible, viz., The one the lesser, *the proximal or gastro-hepatic circle,* located in the lesser gastric curvature; the other, the greater—*the distal or hepato-splenic circle* located on the greater gastric curvature. The concentric gastric circles, constant structures, are of ample interest—anatomic, physiologic, and pathologic—to demand attention. The "concentric gastric circles" are formed by the anastomosis of the proximal and distal "gastric arches," i. e., by the inosculation of the right and left gastric artery proximally and gastro-epiploic artery distally.

The Proximal Gastric Circle (Gastric Artery).

The proximal or gastro-hepatic circle, the lesser gastric circle is formed by the inosculation of the right and left gastric arteries. It is a constant circle and of equal interest to that of Willis. The proximal gastric arch is some 8 to 10 inches in length. A half dozen years ago Dr. W. E. Holland published an article on this subject, naming it the "Byron Robinson gastro-hepatic circle." Since that time I have devoted considerable time and attention to the matter, and now view the above circle as half the story.

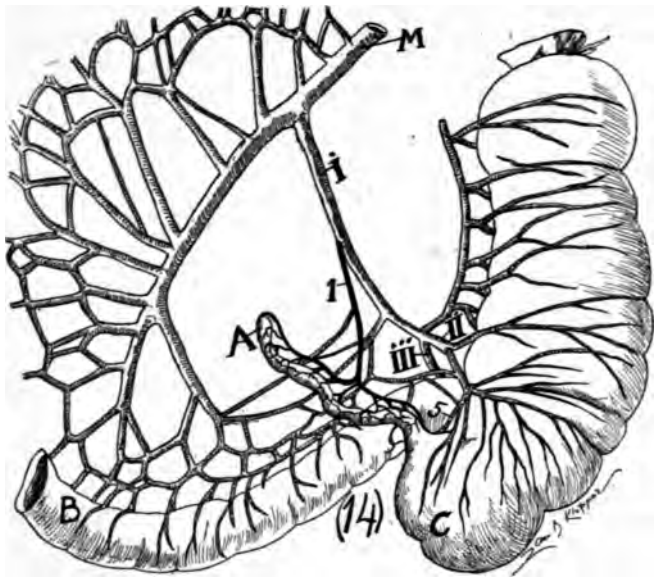
The stomach possesses two concentric circles (a proximal and distal) of equal clinical interest. By the B. N. A. anatomic nomenclature the lesser gastro hepatic circle completes its anastomosis through the ramus anastomoticus which unites the right end of the gastric artery (ex-arteria hepatica) with the left end of the gastric artery (exarteria coeliaca) producing the proximal gastric arch. The lesser, the gastro-hepatic circle is a constant structure. It is of practical interest in medicine and surgery. In the central portion of the gastric artery it bifurcates and reunites forming an oval 3x6 inches in length which I term the "circle of the gastric artery."

The plan of the blood apparatus of the stomach is similar to that of the general tractus intestinalis, viz., trunk, branch, arch, "straight terminal vessel." The gastric artery is a branch and an arch of the coeliac trunk, while its rami gastrici—gastric branches—constitute the "straight terminal vessel" of the stomach.

Distal Gastric Circle (Gastro-Epiploic Artery).

For this subject see *Medical Standard,* Feb. 1908.

General remarks. The gastric artery, the smallest of the three branches of the coeliac trifurcation is remarkable for its maximum dimension at its left origin while its right origin is equally remarkable for its minimum dimension. It describes a circular sinuous course along the minor gastric curvature from its left origin at the coeliac axis to its right origin at the middle third of the hepatic artery. The gastric artery is the smaller and proximal arch of two concentric gastric circles. The gastric artery is of significant importance in surgical procedures from the fact that frequently it emits a branch of marked dimension to the liver. Hence the ligation of the gastric artery adjacent to its left origin may seriously jeopardize the vascular supply of the liver, i. e., the lobus sinistra. (see figures (40), (44), (47), (51), (53). In extripating the stomach as regards the blood supply the gastric artery should be ligated at the right and left origins. The gastro-epiploic artery should also be ligated at its right and left origins, i. e., at its left origin from the splenic artery and its



ARTERIA APENDICULARIS. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." STRAIGHT TERMINAL VESSEL." "ILEAL ARTERY."

Fig. 14. Specimen injected, dissected, dried and employed as a model by the artist, Zan D. Klopper. Dorsal view. A, appendix. B, ileum. C, cecum. I., arteria ileocolic. II., arteria ileocoecalis dorsalis. III., arteria ileocoecalis ventralis.

1, Arteria appendicularis, a single vessel of considerable dimension, arises from the right circumference of the ileocolic circle, i. e., the ileocolic artery. The appendicular artery emits 11 branches to the appendix. 5, is the anastomotic branch between the cecum and appendix.

."Ileocolic circle" is formed by the bifurcation of the arteria mesenterica proximal into the ileocolic and ileal arteries and completed by their distal anastomosis. The signification of the ileocolic circle is that it generally emits the arteria appendicularis which immortalizes it among vascular circles. It is a constant structure located in the ileocolic angle, and is a primordial vascular landmark. It is a typical "inosculation circle" consisting of a vascular arc, peripheral automatic specialized ganglia and a peripheral viscus. "Ileocolic circles, 4. The function of an "inosculation circle" is to congest its peripheral viscus to acentuate common visceral function (sensation, absorption, secretion, peristalis) and it be the genital "inosculation circle" to accentuate special function (menstruation, ovulation, gestation). "Straight terminal vessel" of ample length for clamp or ligature.

For more complete description see section II., page 13. The appendicular artery, of considerable dimension is not compromised with facility by meso appendicitis.

right origin from the hepatic artery as it courses ventral to the caput pancreaticus. Hence, to extirpate the gastrium ligate the gastric and gastro-epiploic arteries—the proximal and distal gastric arches—at their right and left origins. Pyloric branches—*rami pylorici*—of limited number and caliber from the gastro epiploic artery may require clamping from active anastomotic oozing. In viscera there is a tendency to form distinct vascular circles, anastomosis the "inosculation circle"—both the gastric and gastro-epiploic arteries are sinuous in their course, and of greater length than the respective curvatures at rest in order that the distention and contraction of the stomach may be accommodated.

From the given description it is evident that the stomach is surrounded by an uninterrupted arterial circle formed by the gastric artery and gastro epiploic artery. Also that the branches derived from this arterial circles constitute a solid and compact anastomatic network on the dodorsal and ventral gastric walls.

The rock and base of circulation is the anastomosis and a frequent form is that of the "inosculation circle" in relation to viscera—e. g. "utero-ovarian circle," "ileocolic circle," "ileocolic arches" "concentric gastric circles," "ovarian circles." Circles of Willis. One of the greatest therapeutic problems is to control the volume of blood in the "vascular circles" for blood prevents and cures disease. The means by which blood is controlled in anastomosis or the "inosculation circle" is by stimulating automatic specialized ganglia located along the vascular circle and within the peripheral viscus. They are stimulated by hot douches, tampon, electricity, massage, gestation. For example, the gangli located on the "ileocolic circle" may be stimulated by massage, by cathartics, by visceral drainage, by exercise, by electricity, by eating coarse food—all of which entices blood to the enteron from the "ileocolic circle."

The natural stimulation of the "concentric gastric circles" (composed of the gastric and gastro-epiploic arteries) is fluid and food, as similarly the natural stimulation of the "utero-ovarian circle" is menstruation and gestation

III. GASTRO-EPIPLOIC ARTERY.

Arteria Gastro-Epiploica.

The gastro-epiploic artery begins at the hepatic artery and ends at the splenic artery. It is the nutritive artery of the major gastric curvature, adjacent to which it is located.

The gastro-epiploic artery is an arc with a left origin from the splenic and a right origin from the hepatic artery. (I discard the gastro-dudodenal artery.) The distal concentric gastric circle is completed by the splenic and common hepatic trunk. The gastro-epiploic artery (dextra) is one of the two bifurcating branches of the common hepatico-gastric trunk. The concavity of the gastro epiploic artery—the distal concentric gastric circle—is directed proximalward.

The gastro-epiploic artery is unpaired and remarkable for its liberal dimension, diameter and length and marked pulsations, peristalsis.

The Topography of the gastro-epiploic artery may be condensed in the four following propositions, viz.:

Holotopy (relation to general body).

The gastro-epiploic artery is located bilaterally symmetrical in the central portion of the trunk.

Skeletopy (relation to osseous system).

The gastro-epiploic artery possesses a variable location according to the distended or contracted state of the stomach and also according to the form of the stomach. Perhaps the most general location of the gastro-epiploic artery (i. e., the distal portion of the arc) is on a level with the (XI.) dorsal vertebra and (X.) costal arch. The right origin of the gastro-epiploic artery is on a level with the (I.) lumbar vertebra. The left origin is on a level with the (XII.) dorsal vertebra.

Syntopy (relation to adjacent viscera).

The gastro-epiploic artery is intimately associated with the greater gastric curvature, the omentum majus, the caput pancreaticus, pylorus, duodenum, spleen, jejunum, ileum, liver, gall bladder, ventral abdominal wall, right transverse, left and sigmoid colon.

P. *Idiotopy* (relation to component segments).

The component segments of the gastro-epiploic artery are continuous, however variable in diameter. The origin of the right end of the artery is located considerably more distalward than that of the left end. The component segments form an arc with its concavity presenting proximalward.

artery. The gastric artery is the smaller arch of two concentric gastric circles. The gastric artery is of significant importance in surgical procedures from the fact that frequently it emits a branch of marked dimension to the liver. Hence the ligation of the gastric artery adjacent to its left origin may seriously jeopardize the vascular supply of the liver—the lobus sinistra—(See figures (40), (44), (47), (51), (53), (—). In extirpating the stomach as regards the blood supply the gastric artery should be ligated at the right and left origins. The gastro-epiploic artery should also be ligated at its right and left origins, i. e., at its left origin from the splenic artery and its right origin from the gastro-epiploic artery as it courses ventral to the caput pancreaticus. Hence, to extirpate the gastrium ligate the gastric and gastro-epiploic arteries—the proximal and distal gastric arches—at their right and left origins. Pyloric branches—rami pylorici—of limited number and caliber from the gastro-duodenal artery may require clamping from active anastomotic oozing In viscera there is a tendency to form distinct vascular circles. Both the gastric and gastro-epiploic arteries are sinuous in their course, and of greater length than the respective gastric curvatures when at rest, in order that the distention and contraction of the stomach may be accommodated.

(B.) Gastro-Epiploic Artery. Arteria Gastro-Epiploica

"Distal Concentric Gastric Circle."

Synonyms. Arteria gastrica inferior. Arcus gastricus inferior. Arcus gastricus major. Arcus arteriosus gastricus inferior. Arteria coronaria ventriculi inferior. Arcus arteriosus gastricus major. Arteria gastrica ventriculi major. Arteria gastrica distal. Distal gastric artery Magen-Netzpulsader I'arteriae gastro-epiploique.

Note. I shall assume that the term arteria gastro-epiploica is correct and that it should be described as a single, indivisible, continuous artery similar to the arteria uterina ovarica. The location of inosculation cannot be indicated or marked. For convenience of description the right origin—origo dextra and left origin—origo sinistra may be employed. The arteria gastrica epiploica may vary in diameter in different segments, however, that does not render a clue to the point of inosculation. The arteria gastro-epiploica will be described as (III) gastro-epiploica dextra and (IV) gastro-epiploica sinistra.

(III). Arteria Gastro-Epiploica (Dextra).

Right Gastro-Epiploic Artery.

Synonyms. Arteria gastrica inferior dextra. Arteria coronaria ventriculi inferior dextra. Right gastro-epiploic artery. Right inferior gastric artery. Rechte Untere Magen-Netzpulsader, L'arterie gastro-epiploique droite.

Origin. The arteria gastro-epiploica dextra arises as a bifurcation from the arteria hepatic. It originates in the region of the pylorus.

Course. It courses sinuously from right to left between the two ventral blades of the omentum minus, adjacent and parallel to the major gastric curvature. It inosculates with the arteria gastro-epiploica sinistra, or left gastro-epiploic artery (ex arteria lienalis). It passes vertically distalward dorsal to the proximal portion of the duodenum and adjacent to the duodenum. It courses between the caput pancreaticus and pylorus.

Dimension. The arteria gastro-epiploica dextra possesses a diameter of ⅛ of an inch and its length cannot be measured as it has an indefinable segment of the indivisible arteria gastro-epiploica. The artery is remarkable for its dimensions and vigorous pulsation. It forms next to the utero-ovarian and transverse mesocolic arch, the longest vascular arch in the body.

Location. It is situated adjacent and parallel to the major gastric curvature between the two ventral omental blades.

(IV). Arteria Gastro-Epiploica (Sinistra).

Left Gastro-Epiploic Artery.

Synonyms. Arteria gastrica sinistra inferior. Arteria coronaria ventriculi inferior sinistra. Left inferior gastric artery. Left distal gastic artery. Lenke Untere Magen-Netzpulsader, L'arterie gastro-epiploique gauche.

Origin. The arteria gastro-epiploica sinistra arises from the arteria lienalis adjacent to the cauda pancreatica. It appears as a continuation of the splenic artery with its direction reversed. It may arise from the trunk or branch of the splenic artery.

Course. It courses from left to right ventral to the cauda pancreatica and between the blades of the omentum major. It pursues its course adjacently parallel to the major gastric curvature to inosculate with the arteria gastro-epiploica dextra. It appears as a continuation of the splenic artery with its direction changed. It first directs itself proximalward and leftward toward the fundus of the stomach lying dorsal to it. Secondly, it directs itself distalward and rightward adjacently parallel to the major gastric curvature.

Location. It is located parallel to the major gastric curvature and between the ventral blades of the omentum majus.

Dimension. It possesses a diameter of 1/8 of an inch and its length cannot be measured as it is an indefinable segment of an indivisible arch. It is generally equal in diameter to that of the arteria gastro-epiploica dextra, however, frequently its diameter exceeds that of the right gastro-epiploic and would suggest the idea of its dominating magnitude exactly similar to that of the arteria gastrica sinistra, exceeding that of the arteria gastrica dextra. The artery is remarkable for its dimension and vigorous pulsation, especially during gastric gestation.

Ramus Anastomoticus.

The inosculating branch. By means of the ramus anastomoticus the arteria gastro-epiploica dextra and sinistra are compactly inosculated, forming the distal "concentric gastric circle," arcus gastricus distal or arcus arteriosus gastricus distal (major). The inosculation of the right and left gastro-epiploic artery resembles that of a stovepipe—presenting no visible change in diameter or conjunction.

The ramus anastomoticus produces through the arteria epiploica dextra and sinistra a single, indivisible artery—the distal gastric vascular arch—the arteria gastro-epiploica. The left gastro-epiploic artery (ex arteria splenica) solidly inosculates with the right gastro-epiploic artery (ex arteria hepatica). It is the "greater concentric gastric vascular circle."

Arteria Gastro—Epiploica.

Distribution. Arteria gastro-epiploica distributes branches to the stomach, omentum majus and colon transversum. Since the arteria gastro-epiploica (sinistra et dextra) is compactly inosculated, it is a single indivisible artery and its branches will be known as emissions of the gastro-epiploic artery.

Branches. The arteria gastro-epiploica emits numerous branches from its proximal border to the dorsal and ventral surface of the greater gastric curvature. These branches known as rami gastrici dorsal et ventral, richly anastomose with the rami gastrici dorsal et ventral from the arteria gastrica. The arteria gastro-epiploica emits branches—6 to 10—(figure 60) to the omentum majus from its distal border. These branches to supply the great omentum, known as rami epiploici are of considerable length and diameter.

General remarks The arteria gastro-epiploica is remarkable for its dimen-

tude, that the left end is the origin, exactly similar to that of the arteria gastrica sinistra, exceeding that of the arteria gastrica sinistra.

Ramus Anastomoticus.

The Inosculation Branch.

By means of the ramus anastomoticus the inosculation of the right and left gastro-epiploic artery resembles that of a stove-pipe—no visible change in diameter or conjunction.

The ramus anastomoticus produces with the arteria epiploica dextra and sinistra a single, indivisible artery—the distal gastric vascular arch—the arteria gastro-epiploica. The left gastro-epiploic artery (ex-arteria splenica) solidly inosculates with the right gastro-epiploic artery (ex-arteria hepatica). It is the "greater concentric gastric circle."

Arteria Gastro-Epiploica—Gastro-Epiploic Artery.

"Distal Concentric Gastric Circle."

Synonyms. Arteria gastrica inferior. Arcus gastricus inferior. Arcus gastricus major. Arcus arteriosus gastricus inferior. Arteria coronaria ventriculi inferior. Arcus arteriosus gastricus major. Arteria gastrica ventriculi major. Arteria gastrica distal. Distal gastric artery. Magen-Netzpulsader. L'arteriae gastro-epiploique.

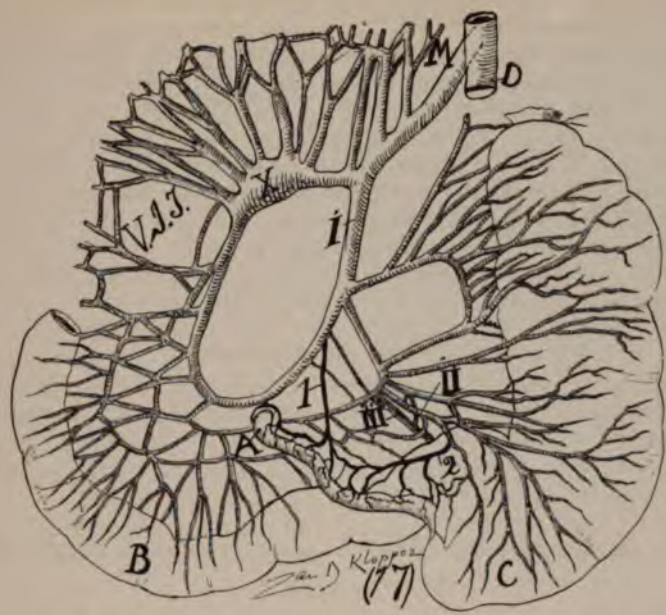
The gastro-epiploic artery is considered as a single indivisible vessel with a right origin from the hepatic and a left origin from the splenic artery. Since the arteria gastro-epiploica (sinistra et dextra) is compactly inosculated, it is a single indivisible artery and its branches will be known as emissions of the gastro-epiploic artery.

Distribution. The gastro-epiploic artery, or arteria gastro-epiploica, distributes branches to the stomach, pancreas, omentum majus, duodenum and colon transversum.

Branches. In its horizontal course the arteria gastro-epiploica emits numerous flexous branches from its proximal border to the dorsal and ventral surface of the greater gastric curvature. These branches, known as *rami gastrici,* dorsal et ventral, richly anastomose with the rami gastrici, dorsal et ventral, from the arteria gastrica. The arteria gastro-epiploica emits branches—epiploic arteries right, middle and left—arteriae epiploicae dextrae mediae et sinistrae) 6 to 10 (fig. 60) to the omentum majus from its distal horizontal border. These branches, long, slender and slightly sinuous, supplying the great omentum, known as rami epiploici, are of considerable length, diameter and solid anastomosis.

In the distalward course of the gastro-epiploic artery on the right side, it emits branches to the duodenum. The gastro-epiploic artery emits the *arteria pancreatico-duodenalis* (proximal) as it passes the distal border of the pylorus. The pancreatico-duodenal artery courses between the head of the pancreas and duodenum, emitting branches to both organs. The pancreatico-duodenal artery bifurcates, one branch passing on the ventral surface of the head of the pancreas to anastomose with the arteria pancreatico-duodenalis distal from the branches of the jejunal artery, the other coursing ventral to the head of the pancreas. The pancreas receives, also, a branch which traverses on its dorsal surface, anastomosing with the splenic and its branches. These three branches are of considerable dimensions, conducting a vigorous stream of blood.

In the distalward course of the gastro-epiploic artery on the left side, it may emit a branch to the pancreas. It not infrequently emits a large branch to the left border of the omentum majus. It may emit one of the vasa brevia. All the branches of the gastro-epiploic artery are solidly and compactly anas-



ARTERIA APPENDICULARIS. "ILEO-COLIC CIRCLE." "STRAIGHT TERMINAL VESSEL." "ILEO-COLIC ARCHES." "ILEAL ARTERY."

Fig. 17. Specimen injected, distended, dried and employed as a model by the artist, Zan D. Klopper. Dorsal view. A, appendix. B, ileum. C, cecum. I, arteria ileo-colica. II, arterial ileo-coecalis. III, arteria ileo-coeclis ventralis.

1, arteria appendicularis, a vessel of limited dimension, arises from the right circumference of the ileo-colic circle. A secondary vessel arises from the dorsal ileo-coecal artery. The appendicular artery emits 14 branches to the appendix. Meso appendicular arches exist.

The "ileo-colic circle" is formed by the bifurcation of the jejunal artery into the ileo-colic and ileal arteries and completed by their distal anastomosis.

It is a typical "inosculation circle," consisting of vascular arc, automatic specialized peripheral ganglia and peripheral viscus. Its function is to engorge its peripheral viscus, "ileo-colic arches number 7. X represents an aneurism of the ileal artery. Right distal "Major Meso-colic circle" present. For more complete description see section II., page 13.

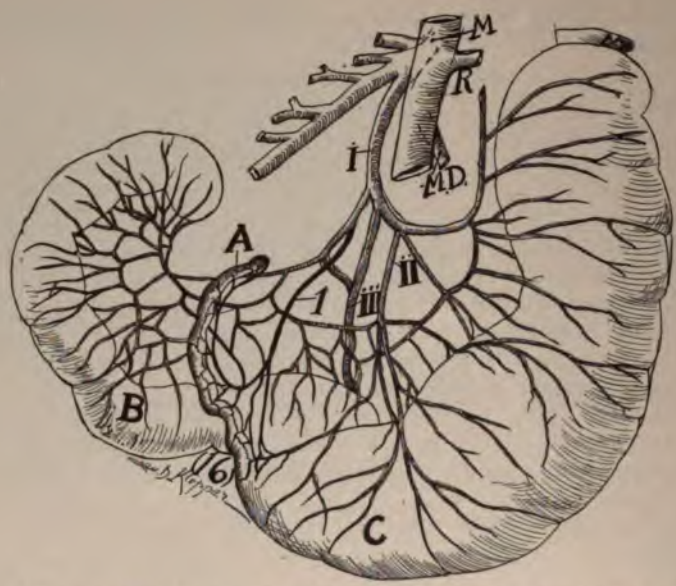
other and with rami gastro-epiploici (dorsal et ventral), producing solid and compact vascular anastomosis. The arteria gastrica emits small twigs to the omentum minus

Ramus hepaticus. Frequently the arteria gastrica emits a branch some three inches from its origin to the left lobe of the liver. It may, perchance supply the entire left liver lobe displacing the ramus hepaticus proprius sinister. Since the arteria gastrica may emit frequently a large branch to the liver the first branch of the coeliac artery may be termed the gastro-hepatic artery (arteria gastric hepatica).

Rami pylorici. The right gastric artery emits several branches to the proximal and distal surface of the pylorus. The pyloric branches may anastomose with the branches of the arteria gastro-epiploica dextra.

Arteria diaphragmatica may be emitted from the gastric artery. It supplies mainly the diaphragm and adrenal of its corresponding side.

General remarks. The gastric artery, the smallest of the three branches of the coeliac trifurcation is remarkable for its maximum dimension at its left origin while its right origin is equally remarkable for its minimum dimension. It describes a circular sinuous course along the minor gastric curvature from its origin at the coeliac axis to its right origin at the middle third of the hepatic



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE." "STRAIGHT TERMINAL VESSEL." "ILEOCOLIC ARCHES." "ILEAL ARTERY."

Fig. 16. Specimen injected, distended, dried and employed as a model by the artist, Zan D. Klopper. Dorsal view. A, appendix. B, ileum. C, cecum. I, arteria ileocolica. II, arterial ileocoecalis. III, arteria ileocoeclis ventralis.

1, arteria appendicularis, a single vessel of limited dimension, arises from the right circumference of the ileocolic circle (incompletely present). The appendicular artery emits 12 branches to the appendix.

For further description, see section II., page 13.

terminal vessel of the intestine (vas intestinii terminale rectum), extending from the mesenteric arches to the intestine. In other words, there is trunk, branch and straight terminal vessels typically manifest in the blood supply of the colon and enteron.

The stomach possesses exactly a similar condition, which is evident when demonstrated. The great trunk for the gastrium is the coeliac trunk (truncus coeliacus); the branch for the stomach is the gastric artery, and in the stomach the branch and arch are practically united; finally, the straight terminal vessel of the stomach (vas gastrici terminale rectum). The straight vessel of the gastrium arises from the branches of the coeliac axis (gastric, hepatic, splenic). Hence the arrangement of the blood apparatus of the stomach resembles the arrangement of the blood apparatus of the tractus intestinalis and consists of a trunk, a branch, an arch, and a straight terminal vessel. See figure (63). The gastrium could be extirpated, leaving *in situ* the two concentric gastric circles, by simply incising the straight terminal vessel.

"CONCENTRIC GASTRIC CIRCLES."

Composed of: (A) Arteria Gastricia and (B) Arteria Gastro-Epiploica.

(A). Gastric Artery. Arteria Gastrica. Proximal Concentric Circle.

Synonyms. Proximal gastric circle. Arteria gastrica superior. Arcus gastricus proximal. Arcus gastricus minor. Arcus arteriosus gastricus proximal. Arcus arteriosus gastricus minor. Arteria coronaria ventriculi proximal. Arteria coronaria ventricula superior. Arteria coronaria ventriculi minor. Proximal gastric artery. Artere Coronaire Stomachique.

Note. I shall assume that the term arteria gastrica is correct and that it should be described as a single, indivisible, artery similar to the utero-ovarian. The location of the inosculation of the right and left gastric artery cannot be indicated or marked. For convenience of description the terms right origin—origa dextra and left origin—origigenta sinistra may be employed. It is true th· gastric artery may vary in diameter in different segments, however, this fact does not furnish the clue to the point of inosculation. The arteria gastrica will be described as (I) arteria gastrica dextra and (II) as arteria gastrica sinistra.

Right Gastric Artery.

I. Arteria Gastrica (Dextra).

Synonyms. Arteria pylorica. Arteria gastrica minor. Arteria coronaria ventriculi dextra. Arteria gastrica superior dextra. Right gastric artery. Artere coronaire stomachique droite, rechte ober magen puls ader.

Origin. The arteria gastrica dextra or right gastric artery arises: (a) from the right branch of the arteria hepatica propria; (b) from the arteria hepatica communis; (c) from the left branch of the arteria hepatica propria; (d) from the arteria gastro-duodenalis (see figures (30), (38), (40), (42), (43), (44), (45), (46), (47), (48), (49), (51), (53), (56), (57), (60) (—).

Course. The course of the arteria gastrica dextra is first distalward toward the pylorus whence it directs itself leftward in a curved, sinuous course between the blades of the omentum minus parallel and adjacent to the minor gastric curvature to inosculate with the arteria gastric sinistra. The distance between the gastric artery and lesser gastric curvature varies from direct contact to three-fourths of an inch.

Dimension. It is 1/12th of an inch in diameter and its length cannot be measured as the arteria gastrica forms one indivisible artery similar to the arteria uterina ovarica. Its diameter is greater at its origin than 4 inches leftward. It extends from the coeliac artery to the arteria hepatica propria. The root of the arteria gastrica dextra is of less dimension than that of the arteria gastrica sinistra.

Location. The arteria gastrica dextra is situated in the right portion of the minor gastric curvature between the blades of the omentum minus.

Left Gastric Artery.

II. Arteria Gastrica (Sinistra.).

Synonyms. Arteria coronaria ventriculi sinistra. Arteria gastrica superior sinistra. Arteria coronaria ventriculi superior. Gastro-hepatic artery. Arteria gastrica major. Arteria gastrica magna. Left gastric artery. Lenke obere magen puls ader. Artere coronarie stomachique gache.

Origin. It arises: 1st, as a rule from the proximal surface of the trunk of the coeliac artery between its origin and bifurcation into hepatic and splenic arteries. 2d, it may arise from the arteria splenica or 3d, from the arteria hepatica communis, 4th, it may arise as one of the trifurcating branches of the coeliac axis.

Course. It courses proximalward, ventralward and leftward over the left crus of the diaphragm in a special fold of peritneum to the cardiac orifice of the stomach, to supply the cardia whence it directs itself by an acute angle in a curved course, rightward, parallel, to the lesser curvature of the stomach between the blades of the omentum minus to inosculate with the arteria gastrica dextra (ex arteria hepatica). It pursues a semi-circular course between the blades of the omentum minus. The course of the artery varies considerably as to its distance from the lesser gastric curvature. It not infrequently bifurcates and courses adjacent to the cardiac orifice and course as two oval vessels of equal

volume practically to pylorus. It frequently bifurcates to re-unite forming a vascular circle of considerable dimension.

Location. Dorsal to the omentum minus. It practically terminates by inosculating with the right gastric artery. It is located in the lesser curvature of the stomach.

Dimension. The arteria gastrica sinistra is about one-sixth of an inch in diameter at its origin at the coeliac axis. It possesses the minimum dimension of the three coeliac branches and gradually diminishes toward the middle of the lesser curvature.

Its length cannot be designated as the point of its inosculation with the arteria gasterica dextra cannot be located.

Ramus Anastomoticus.

The Inosculation of Right and Left Gastric Arteries. Ramus anastomoticus is the means by which the arteria gastrica dextra et sinistra become solidly inosculated. The right gastric artery (ex arteria hepatica) becomes compactly anastomosed to the left gastric artery (ex arteria coeliaca), forming a single, indivisible, continuation of some 8 to 10 inches in length. The ramus anastomoticus unites the right and left gastric arteries producing the "proximal concentric gastric circle" or arcus arteriosus gastricus proximal. It is the lesser "concentric gastric circle." Since the gastric artery, right and left forms by inosculation a single, indivisible, continuous vessel similar to the arteria uterina ovarica, all its branches will be known as branches of the gastric artery. Not infrequent the gastric artery courses as a double parallel vessel of almost equal volume for one-third to one-half its length in its middle portion, and these two branches may inosculate forming a distinct vascular circle, in the lesser gastric curvature of considerable magnitude. This I term the "circle of the gastric artery." The course of the gastric artery may not only present sinuosity by angularity.

Branches of the Gastric Artery.

The branches of the gastric artery arise from its convexity—practically no branches arise from the concavity of the gastric artery. The branches of the gastric artery pass perpendicular to the gastric axis similar to those of the gastro-epiploica.

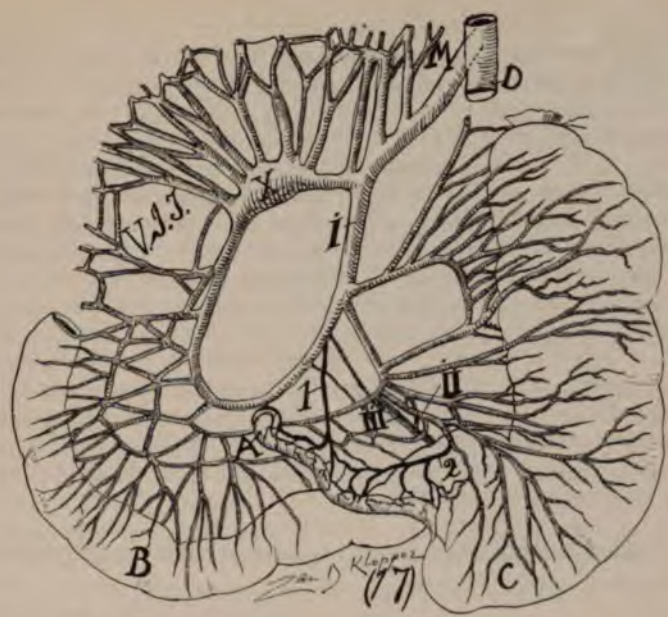
The oesophageal branches—rami oesophagei—vary in number and assume a verticle or transverse course.

The verticle or proximalward directed branch (1 or more) arises from the convexity of the gastric artery adjacent to the cardia. It courses proximalward on the oesophagus through the oesophageal aperture to the dorsal mediastinum, distributing itself by numerous flexuous twigs to the oesophagus and anastomosing with the aortic oesophageal branches—several—surround the cardia in a semi-circular course constituting the rami-cardiaci with a horizontal direction. They distribute themselves to the oesophagus, to the gastric cul-de-sac and others anatomose with the arteriae gastricae breves.

Rami gastrici (ventral et dorsal) emerge from the arteria gastrica as it courses along the lesser curvature passing to the ventral and dorsal gastric surface in irregular numbers and dimension. The dorsal surface is supplied the most abundantly.

If the gastric artery divide to form a vascular circle (which is the rule) the dorsal gastric branches arise mainly from the dorsal circumference and the ventral gastric branches arise from the ventral circumference of the vascular circle of the gastric artery.

The branches separate into vast numbers of separate twigs, which penetrate between the mucous and muscular coats of the stomach and anastomose with each



ARTERIA APPENDICULARIS. "ILEO-COLIC CIRCLE." "STRAIGHT TERMINAL VESSEL." "ILEO-COLIC ARCHES." "ILEAL ARTERY."

Fig. 17. Specimen injected, distended, dried and employed as a model by the artist, Zan D. Klopper. Dorsal view. A, appendix. B, ileum. C, cecum. I, arteria ileo-colica. II, arterial ileo-coecalis. III, arteria ileo-coeclis ventralis.

1, arteria appendicularis, a vessel of limited dimension, arises from the right circumference of the ileo-colic circle. A secondary vessel arises from the dorsal ileo-coecal artery. The appendicular artery emits 14 branches to the appendix. Meso appendicular arches exist.

The "ileo-colic circle" is formed by the bifurcation of the jejunal artery into the ileo-colic and ileal arteries and completed by their distal anastomosis.

It is a typical "inosculation circle," consisting of vascular arc, automatic specialized peripheral ganglia and peripheral viscus. Its function is to engorge its peripheral viscus, "ileo-colic arches number 7. X represents an aneurism of the ileal artery. Right distal "Major Meso-colic circle" present. For more complete description see section II., page 13.

other and with rami gastro-epiploici (dorsal et ventral), producing solid and compact vascular anastomosis. The arteria gastrica emits small twigs to the omentum minus

Ramus hepaticus. Frequently the arteria gastrica emits a branch some three inches from its origin to the left lobe of the liver. It may, perchance supply the entire left liver lobe displacing the ramus hepaticus proprius sinister. Since the arteria gastrica may emit frequently a large branch to the liver the first branch of the coeliac artery may be termed the gastro-hepatic artery (arteria gastric hepatica).

Rami pylorici. The right gastric artery emits several branches to the proximal and distal surface of the pylorus. The pyloric branches may anastomose with the branches of the arteria gastro-epiploica dextra.

Arteria diaphragmatica may be emitted from the gastric artery. It supplies mainly the diaphragm and adrenal of its corresponding side.

General remarks. The gastric artery, the smallest of the three branches of the coeliac trifurcation is remarkable for its maximum dimension at its left origin while its right origin is equally remarkable for its minimum dimension. It describes a circular sinuous course along the minor gastric curvature from its origin at the coeliac axis to its right origin at the middle third of the hepatic

artery. The gastric artery is the smaller arch of two concentric gastric circles. The gastric artery is of significant importance in surgical procedures from the fact that frequently it emits a branch of marked dimension to the liver. Hence the ligation of the gastric artery adjacent to its left origin may seriously jeopardize the vascular supply of the liver—the lobus sinistra—(See figures (40), (44), (47), (51), (53), (—). In extirpating the stomach as regards the blood supply the gastric artery should be ligated at the right and left origins. The gastro-epiploic artery should also be ligated at its right and left origins, i. e., at its left origin from the splenic artery and its right origin from the gastro-epiploic artery as it courses ventral to the caput pancreaticus. Hence, to extirpate the gastrium ligate the gastric and gastro-epiploic arteries—the proximal and distal gastric arches—at their right and left origins. Pyloric branches—rami pylorici—of limited number and caliber from the gastro-duodenal artery may require clamping from active anastomotic oozing In viscera there is a tendency to form distinct vascular circles. Both the gastric and gastro-epiploic arteries are sinuous in their course, and of greater length than the respective gastric curvatures when at rest, in order that the distention and contraction of the stomach may be accommodated.

(B.) Gastro-Epiploic Artery. Arteria Gastro-Epiploica

"Distal Concentric Gastric Circle."

Synonyms. Arteria gastrica inferior. Arcus gastricus inferior. Arcus gastricus major. Arcus arteriosus gastricus inferior. Arteria coronaria ventriculi inferior. Arcus arteriosus gastricus major. Arteria gastrica ventriculi major. Arteria gastrica distal. Distal gastric artery Magen-Netzpulsader I'arteriae gastro-epiploique.

Note. I shall assume that the term arteria gastro-epiploica is correct and that it should be described as a single, indivisible, continuous artery similar to the arteria uterina ovarica. The location of inosculation cannot be indicated or marked. For convenience of description the right origin—origo dextra and left origin—origo sinistra may be employed. The arteria gastrica epiploica may vary in diameter in different segments, however, that does not render a clue to the point of inosculation. The arteria gastro-epiploica will be described as (III) gastro-epiploica dextra and (IV) gastro-epiploica sinistra.

(III). Arteria Gastro-Epiploica (Dextra).

Right Gastro-Epiploic Artery.

Synonyms. Arteria gastrica inferior dextra. Arteria coronaria ventriculi inferior dextra. Right gastro-epiploic artery. Right inferior gastric artery. Rechte Untere Magen-Netzpulsader, L'arterie gastro-epiploique droite.

Origin. The arteria gastro-epiploica dextra arises as a bifurcation from the arteria hepatic. It originates in the region of the pylorus.

Course. It courses sinuously from right to left between the two ventral blades of the omentum minus, adjacent and parallel to the major gastric curvature. It inosculates with the arteria gastro-epiploica sinistra, or left gastro-epiploic artery (ex arteria lienalis). It passes vertically distalward dorsal to the proximal portion of the duodenum and adjacent to the duodenum. It courses between the caput pancreaticus and pylorus.

Dimension. The arteria gastro-epiploica dextra possesses a diameter of 1/8 of an inch and its length cannot be measured as it has an indefinable segment of the indivisible arteria gastro-epiploica. The artery is remarkable for its dimensions and vigorous pulsation. It forms next to the utero-ovarian and transverse mesocolic arch, the longest vascular arch in the body.

Location. It is situated adjacent and parallel to the major gastric curvature between the two ventral omental blades.

(IV). Arteria Gastro-Epiploica (Sinistra).

Left Gastro-Epiploic Artery.

Synonyms. Arteria gastrica sinistra inferior. Arteria coronaria ventriculi inferior sinistra. Left inferior gastric artery. Left distal gastic artery. Lenke Untere Magen-Netzpulsader, L'arterie gastro-epiploique gauche.

Origin. The arteria gastro-epiploica sinistra arises from the arteria lienalis adjacent to the cauda pancreatica. It appears as a continuation of the splenic artery with its direction reversed. It may arise from the trunk or branch of the splenic artery.

Course. It courses from left to right ventral to the cauda pancreatica and between the blades of the omentum major. It pursues its course adjacently parallel to the major gastric curvature to inosculate with the arteria gastro-epiploica dextra. It appears as a continuation of the splenic artery with its direction changed. It first directs itself proximalward and leftward toward the fundus of the stomach lying dorsal to it. Secondly, it directs itself distalward and rightward adjacently parallel to the major gastric curvature.

Location. It is located parallel to the major gastric curvature and between the ventral blades of the omentum majus.

Dimension. It possesses a diameter of 1/8 of an inch and its length cannot be measured as it is an indefinable segment of an indivisible arch. It is generally equal in diameter to that of the arteria gastro-epiploica dextra, however, frequently its diameter exceeds that of the right gastro-epiploic and would suggest the idea of its dominating magnitude exactly similar to that of the arteria gastrica sinistra, exceeding that of the arteria gastrica dextra. The artery is remarkable for its dimension and vigorous pulsation, especially during gastric gestation.

Ramus Anastomoticus.

The inosculating branch. By means of the ramus anastomoticus the arteria gastro-epiploica dextra and sinistra are compactly inosculated, forming the distal "concentric gastric circle," arcus gastricus distal or arcus arteriosus gastricus distal (major). The inosculation of the right and left gastro-epiploic artery resembles that of a stovepipe—presenting no visible change in diameter or conjunction.

The ramus anastomoticus produces through the arteria epiploica dextra and sinistra a single, indivisible artery—the distal gastric vascular arch—the arteria gastro-epiploica. The left gastro-epiploic artery (ex arteria splenica) solidly inosculates with the right gastro-epiploic artery (ex arteria hepatica). It is the "greater concentric gastric vascular circle."

Arteria Gastro—Epiploica.

Distribution. Arteria gastro-epiploica distributes branches to the stomach, omentum majus and colon transversum. Since the arteria gastro-epiploica (sinistra et dextra) is compactly inosculated, it is a single indivisible artery and its branches will be known as emissions of the gastro-epiploic artery.

Branches. The arteria gastro-epiploica emits numerous branches from its proximal border to the dorsal and ventral surface of the greater gastric curvature. These branches known as rami gastrici dorsal et ventral, richly anastomose with the rami gastrici dorsal et ventral from the arteria gastrica. The arteria gastro-epiploica emits branches—6 to 10—(figure 60) to the omentum majus from its distal border. These branches to supply the great omentum, known as rami epiploici are of considerable length and diameter.

General remarks The arteria gastro-epiploica is remarkable for its dimen-

The "concentric gastric circles"—marked in black—are plainly visible with gastrium reflected proximalward or in situ.

The "concentric gastric circles" are of practical interest in surgical procedure on the stomach. They are of vastly more practical interest than the circle of Willis, which has maintained its undisputed swa yfor two and a quarter centuries.

The stomach practically lies between the "concentric gastric circles," i. e., the gastric artery proximally and the gastro-epiploic artery distally, and in performing gastrectomy a ligature is required at the right and left end of the gastric artery and also at the right and left end of the gastro-epiploic artery. In ligature of the gastric artery, it is practical to attempt to determine if a ramus hepaticus exist which should not be ligated.

THE "DUODENAL CIRCLE," "ARCUS DUODENALIS."

Arteria Pancreatico-duodenalis Proximal. Arteria Pancreatico-duodenalis distal.

The *"duodenal circle"* or duodenal arc connects the hepatic artery with the jejunal artery. It is solidly and compactly anastomosed with the "Pancreatic Circle." The "duodenal circle" is composed by the solid and compact inosculation of the arteria Pancreatico-duodenalis proximal (superior) with the arteria pancreatico-duodenalis distal (inferior).

A. ARTERIA PANCREATICO-DUODENALIS PROXIMAL.

The Proximal (Superior) Pancreatico-Duodenal Artery.

The Major Pancreatico Duodenal Artery.

Origin. The proximal pancreatico-duodenal artery arises from the right gastro-epiploic artery dorsal to the pylorus. It originates from the gastro-epiploica dextra on a level with the proximal border of the pancreas.

The proximal pancreatico duodenal artery may possess two origins, one from the right gastro-epiploica and the other from the varied sources—the hepatica propria, right gastric epiploica, the aorta, see figures (30), (38), (39), (43), (44), (45), (46), (51), (56), (57), (62). The proximal pancreatico-duodenal artery may arise as one artery and shortly bifurcate—one branch coursing ventral and the other coursing dorsal to the duodenum, see figures (33), (40), (42), (47), (59), (64).

Course. The proximal pancreatico-duodenal artery courses distalward and leftward in the concavity of the duodenum between the duodenum and head of the pancreas, whence it inosculates with the distal pancreatico duodenal artery.

Dimension. The proximal pancreatico duodenalis is an artery of equal or perchance less dimension than that of the right gastro-epiploica. It possesses a diameter of perhaps 1/10 or 1/12 of an inch and its length cannot be measured as its point of inosculation with the distal pancreatico-duodenalis is invisible.

The proximal pancreatico duodenal artery is of greater dimensions than that of the distal.

B. ARTERIA PANCREATICO-DUODENALIS DISTAL.

The Distal (Inferior) Pancreatico Duodenal Artery.

The minor Pancreatico-duodenal artery.

Origin. The distal pancreatico duodenal artery arises singly from the right side of the jejunal artery, see figures (48), (53), (59), (61), (64). It may possess a double origin from the jejunal artery, see figures (25), (30), (38), (39), (40), (41), (43), (44), (45), (47), (51). It may possess a treble origin,

and the inosculation of the right and left gastro-epiploic artery distally. The following table represents the "concentric gastric circles" with their synonyms, viz.: See Page—.

V. The Proximal Gastric Circle.

The proximal or gastro-hepatic, the lesser gastric circle is formed by the inosculation of the right and left gastric arteries. It is a constant circle and of equal interest to that of Willis. The proximal gastric arch is about eight inches in length. Some half dozen years ago Dr. W. E. Holland published an article on this subject, naming it the "Byron Robinson gastro-hepatic circle." Since that time I have devoted considerable time and attention to the matter, and now view the above circle as half the story.

The stomach possesses two concentric circles of equal clinical interest. By the B. N. A. anatomic nomenclature the lesser gastro-hepatic circle completes its anastomosis through the ramus anastomoticus which unites the right end of the gastric artery (ex-arteria hepatica) with the left end of the gastric artery (ex arteria coeliaca) producing the proximal gastric arch.

The gastric artery (i. e., the proximal gastric circle), as a rule bifurcates at its right and left end forming a distinct vascular circle located in the central portion of the lesser gastric curvature. This I call the "circle of the gastric artery."

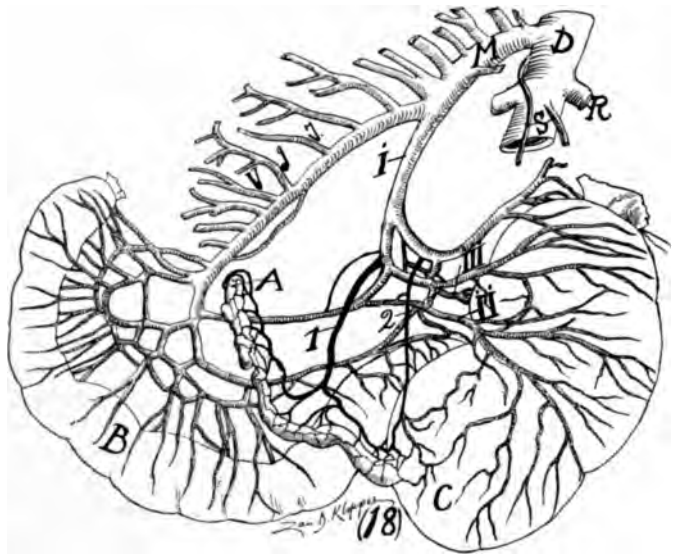
The lesser, the gastro-hepatic circle, is a constant structure. It is of practical interest in medicine and surgery.

V. The Distal Gastric Circle.

If one reflects the stomach proximalward there will be observed a greater gastric circle, the distal gastric circle or the hepato-splenic—located along the greater gastric curvature. The greater gastric circle is formed by the inosculation of the gastro-epiploica dextra and sinistra, and completed by the gastric and splenic branches. The gastro-epiploica dextra arises from the hepatic, while the gastro-epiploica sinistra arises from the splenic and completed by the gastric and splenic branches. The gastro-epiploica dextra arises from the hepatic, while the gastro-epiploica sinistra arises from the splenic. The greater gastric circle is a constant structure. It varies considerably in magnitude during gastric dilation and contraction. It is some 15 inches in length.

The relation of the blood supply of the stomach practically does not differ from that of the enteron and colon, e. g., the blood supply of the enteron is typical, consisting, first, of a large trunk (arteria mesenterica proximal); second, of branches (rami intestinale); third, of mesenteric arches, one to six (arci mesenterii); fourth, of a straight terminal vessel of the intestine (vas intestini terminale rectum), extending from the mesenteric arches to the intesine. In other words, there is trunk, branch, arch and "straight vessel" typically manifest in the blood supply of the colon and enteron.

The stomach possesses exactly a similar condition which is evident when demonstrated (see Fig. 63). The great trunk for the gastrium is the coeliac trunk (truncus coeliacus), the branch for the stomach is the gastric artery, and in the stomach the branch and arch are practically united. Finally, the "straight terminal vessel" of the stomach (vas gastrici terminale rectum). The straight vessel of the gastrium arises from the branches of the coeliac axis (gastric, hepatic, splenic). Hence the arrangement of the blood apparatus of the stomach resembles the arrangement of the blood apparatus of the colon and enteron. In short, the arrangement of the blood apparatus of the tractus intestinalis consists of a trunk, a branch, an arch, and a straight terminal vessel. The gastrium could be extripated, leaving in situ the two consentric gastric circles, by simply incising the straight terminal vessel of the stomach.



ARTERIA APPENDICULARIS. "ILEO-COLIC CIRCLE." "STRAIGHT TERMINAL VESSEL." "ILEO-COLIC ARCHES." "ILEAL ARTERY."

Fig. 18. Specimen injected, distended, dried and employed as a model by the artist, Zan D. Klopper. Dorsal view. A, appendix. B, ileum. C, cecum. I, arteria ileo-colica. II, arterial ileo-coecalis. III, arteria ileo-coeoalis ventralis.

1, arteria appendicularis, a vessel of limited dimension, arises from the right circumference of the ileo-colic circle and 2, a secondary vessel ramus colicus (exarteria ileo-colica). The appendicular arteries emit 8 branches to the appendix.

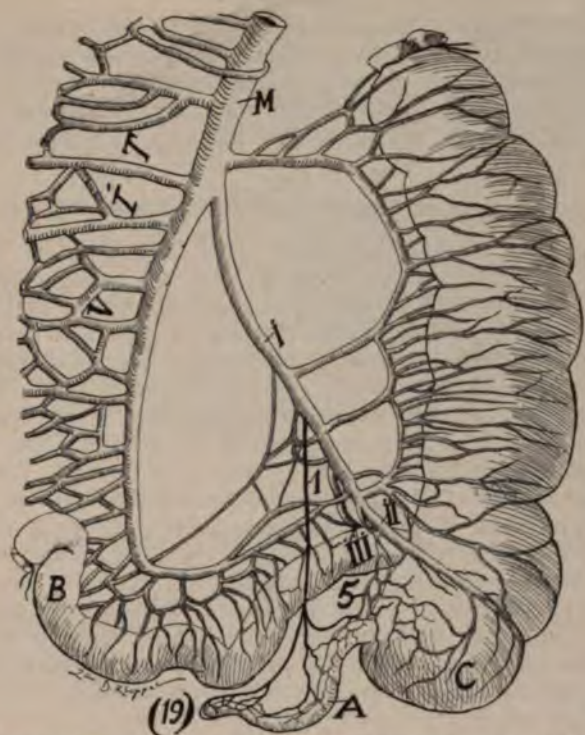
The "ileo-colic circle" is formed by the bifurcation of the artery into the ileo-colic and ileal arteries and completed by their distal anastomosis.

The ileo-colic artery is a typical "inosculation circle" and consists of vascular arc, automatic specialized peripheral ganglia (Auerbach's and Billroth-Meissner's) and peripheral viscus. See section II., page 13.

sions (length and diameter) and vigor. It is the large arch of the two "concentric gastric circles." The gastro-epiploic branches not only anastomose richly with each other, but solidly and compactly with the branches from the gastric artery. The solid and compact anastomoses of the arterial branches to the stomach is almost as solid and compact as that of the uterus. The remarkable dimension and vigorous peristalsis of the gastro-epiploic artery is generally known to observers. After a large meal in spare subjects pulsation is marked. The remarkable capacity of the gastro-epiploic artery for contraction and distention in length is evident. It is a collossal arch—about 15 inches in length—noted by anatomists since the practice of dissention. Among viscera there is a tendency to vascular circles arcs.

The "Concentric Gastric Circles."

If the abdominal arota is completely injected with red lead and starch and the coeliac branches with its trifurcated branches isolated by dissection, two "concentric gastric circles" are visible, viz., the one, the lesser, the proximal or gastro-hepatic circle, located in the lesser gastric curvature; the other, the greater —the distal or hepato-splenic circle, located on the greater gastric curvature. The "concentric gastric circles" constant structures are of ample interest—anatomic, physiologic and pathologic—to demand attention. The "concentric gastric circles" are formed by the anastomosis of the proximal and distal "gastric arches," i. e., by the inosculation of the right and left gastric artery proximally



ARTERIA APPENDICULARIS. "ILEO-COLIC CIRCLE," "ILEO-COLIC ARCHES," "STRAIGHT TERMINAL VESSEL," ILEAL ARTERY.

Fig. 19. Specimen injected, distended, dried and employed as a model by the artist Zan D. Klopper. Dorsal view. A. appendix. B. ileum; C, coecum; M, jejunal artery; I, arteria ileo-coecalis; II, arteria ileo-coecalis dorsalis; III, arteria ileo-coecalis ventralis.

1, arteria appendicularis. a single vessel of limited dimension, arises from the right circumference of the ielo-colic circle. The appendicular artery emits 11 branches to the appendix. 5, ramus anastimoticus, inosculating the appendicular and coecal arteries. The atrophying appendix is supplied by a vessel of limited caliber. Meso appendicitis compromises small vessels with facility.

The "ileocolic circle" a typical "inosculation circle" is formed by the bifurcation of the jejunal artery into the ileocolic and ileal arteries and completed by their distal anastomosis.

The "ileocolic circle" consists of a vascular arc, automatic specialized peripheral ganglia and a peripheral viscus. Its functions is to engorge its peripheral viscus. The ileal artery constitutes the left circumference of the "ileocolic circle."

Straight terminal vessel" is of ample length for ligation or clamping. The "ileocolic arches" number 11. For more complete description see section II., page 13.

viz., from the jejunal artery and rami jejunales, see figures (56), (57). The three origins may be from the jejunal artery, see figure (33).

Course. The distal pancreatico-duodenal artery courses from the jejunal artery rightward and proximal in the concavity of the duodenum between the head of the pancreas and the duodenum whence it inosculates with the proximal pancreatico-duodenal artery.

Dimension. The distal pancreatico duodenal artery is of less dimension than the proximal, perhaps 1/12 or 1/10 of an inch in diameter and its length may not be measured as its point of inosculation with the proximal pancreatico duodenal artery is invisible, not marked.

Ramus Anastomoticus.

The ramus anastomaticus or inosculation of the proximal and distal pan-

creatico-duodenal arteries is the means by which the hepatic artery becomes united to the jejunal artery or the coeliac axis, becomes solidly and compactly united to the jejunal artery or the proximal mesenteric artery. The inosculation between the proximal and distal pancreatico-duodenal arteries is the means by which the gastrium is united to the enteron. It is a "gastro-enteronic circle" or arc.

Pancreatico-Duodenal Artery.

Since the duodenal circle is indivisible, that is its point of inosculation cannot be marked or located, I shall assume that the proximal and distal pancreatico-duodenal arteries are united into one single artery and the appropriate names should be *Arteria Pancreatico-duodenalis.* It not only supplies both duodenum and head of the pancreas with liberal numbers of branches, but constantly unites the hepatic artery solidly and compactly with the jejunal artery as well as furnishing abundant anastomosis with the "Pancreatic circle" This vessel, the *Pancreatico-duodenal artery,* will be considered as a single artery in course, relations, branches.

Course. The course of the pancreatico-duodenal artery is that of an arc, corresponding with that of the duodenum. It is practically a tangent of the "distal concentric gastric circle" (from the right gastro-epiploic artery). In some subjects the course is that of a single artery from its distal origin in the jejunal artery to its proximal origin in the root of the right gastro-epiploic artery—perhaps 1 to 2 inches distant from the hepatic artery. In other subjects the middle segment of the course of the pancreatico-duodenal artery is irregular, uncertain from the fact that it may become divided into two or multiple anastomosing branches.

In the majority of subjects the middle segment becomes divided into two main branches forming an oval loop, one loop frequently coursing dorsal to the head of the pancreas and the other ventral. This I term the "circle of the pancreatico-duodenal artery."

In some subjects the middle portion of the pancreatico-duodenal artery presents practically a rich anastomatic apparatus.

In some subjects the pancreatico-duodenal artery is completely duplicate in origin and course, see figures (44), (45), (46), (51), (56), (57). The pancreatico-duodenal artery may possess unity at one origin and duplicity at the other origin and vice versa. See figures (3), (6), (40), (43), (44), (47), (59), (61), (62), (64).

Origin. The pancreatico-duodenal artery is an arc with two origins the one the distal, from the jejunal artery the other, the proximal from the gastro-epiploica dextra.

Dimension. The pancreatico-duodenal artery is 1/12 to 1/15 of an inch in diameter and some 5 inches in length. The proximal end, arteria gastro-epiploica dextra of the pancreatico-duodenal artery is perhaps twice the diameter of the distal end (Ex arteria jejunalis). The proximal end is more liable to be single the distal end multiple.

Branches of the Pancreatico Duodenal Artery.

The arteria pancreatico-duodenalis proximal (superior) and distal (inferior) are here considered as a single artery with two origins—a proximal one (Ex arteria gastro-epiploica dextra) and a distal one (Ex arteria jejunalis). Hence all branches are considered to arise from a single artery, from the arc of a circle. Dissection exposed the following branches of the arteria pancreatico-duodenalis:

1. *Rami duodenalis,* consist of numerous branches of considerable dimension which nourish the duodenum, see figures (49), (56), (62), (64).

2. *Rami Pylorici,* consist of one or several branches which supply the pylorus, see figure (65).

Rami Pancreatici, consist of numerous branches of considerable dimension which richly supply the pancreatic head and aid to form the solid and compact anastomotic pancreatic apparatus (the "Pancreatic circle"), see figures (40), (47), (48), (49), (51), (56), (57), (59), (62), (64), (65).

4. The pancreatico-duodenal artery emits branches which inosculate with the rami jejunales, see figures (38), (39), (46), (51), (56), (65).

5. *Variable branches.* It may be remembered from dissection that the hepatic artery and the jejunal artery are remarkably solidly anastomosed. In fact the jejunal artery may emit a strong branch to the liver, see figure (36).

A remarkable example of solid inosculation of the hepatic artery to the jejunal artery is figure (43) when (X) shows a strong branch issuing from the hepatic artery coursing distalward dorsal to the jejunal artery and inosculates with the 1st and 2nd rami jejunalies.

Figure (41) presents the rare inosculation of the pancreatic-duodenal artery with the ileocolic artery.

Topography of the Pancreatico Duodenal Artery.

("Duodenal Circle.")

The following four propositions represent the topographic view of the pancreatico-duodenal artery:

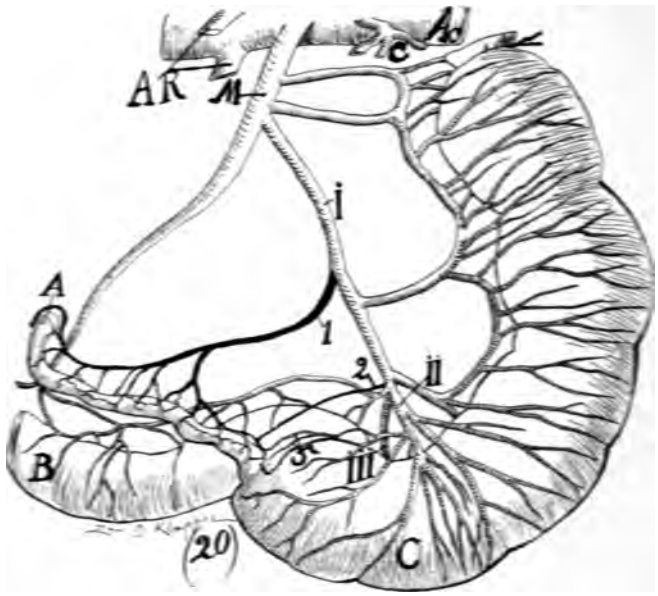
I. *Holotopia.* (Relation to general body). The pancreatico-duodenal artery is located unilaterally in the right proximal quadrant of the abdomen or in the right side and middle of the trunk.

II. *Skeletopia.* (Relation to ossesous system.) The pancreatico-duodenal artery originates from the right gastro-epiploic artery coursing rightward on a level with the I. lumbar vertebrae and passes distalward to inosculate with the jejunal artery or its branches, ventrally opposite to the III. lumbar vertebra.

The length of the pancreatico-duodenal artery covers the space of 2 to 3 lumbar vertebrae.

III. *Syntopia.* (Relation to adjacent viscera.) The pancreatico-duodenal artery is intimately associated with the pancreatic head and duodenum. It extends as an arc or curve, with its concavity leftward and its convexity rightward from the root of the right gastro epiploic artery to the jejunal artery or its branches. Dorsally it is related to the vena cava, portal vein, ductus chaledochus communis, right pillar of the diaphragm right psoas muscle, quadratus lumborum ventrally, the chief segment of the arteria. Pancreatico-duodenalis covered by the peritoneum, courses well venertalward on the concave border of the duodenum and on the ventral surface of the Pancreatic head. The pancreatico-duodenal artery arises from the right gastro-epiploic at the distal border of the pylorus and for half of its course is covered by the distal end of the stomach as it lies ventrally on the horizontal position of the duodenum. Laterally, leftward the pancreatico-duodenal artery emits numerous strong branches, which richly supply the head of the pancreas and forms luxuriant anastomoses with the pancreatic arteries from other sources (arteria hepatica, splenica, jejunal) producing the pancreatic anastomotic apparatus—the "pancreatic circle" or arch. Laterally rightward it is intimate with duodenum, richly supplying it with numerous vessels of considerable dimensions.

(Note, the proximal 2 inches of the duodenum receives the least quantity of blood of any duodenal segment. Hence poverty of blood (as well as character of secretions) may account for the more frequent occurence of ulceration in the proximal 2 inches of the duodenum than any other duodenal segment, hence



ARTERIA APPENDICULARIS. "ILEO-COLIC CIRCLE," "ILEO-COLIC ARCHES," "STRAIGHT TERMINAL VESSEL," ILEAL ARTERY.

Fig. 20 Specimen injected, dissected, dried and employed as a model by the artist, Zan D. Klopper, Dorsal view. A, appendix. B, ileum. C, coecum.

I, arteria ileo-colica. II, arteria ileo-coecalis dorsalis. III, arteria ileo-coecalis ventralis.

Appendicular artery, an artery of considerable dimension. "Ileo-colic circle," a typical "inosculation circle" of marked dimension, consists of a vascular arc, peripheral automatic specialized ganglia and a peripheral viscus. The function of the ileocolic circle is to congest the peripheral viscus for Physiologic purposes, "Ileocolic arches" number 1. Right distal "Major Mesocolic circle" present.

"Ileal artery" extends from the bifurcation of the jejunal artery to its inosculation with the ileocolic artery. 2. a secondary appendicular artery.

The "straight vessel" is of ample length for ligature or clamp. For more complete description see section II, page 13.

duodenal ulceration seldom occurs except as an accompaniment of malignancy. I personally inspected 800 subjects during 16 years without observing a single duodenal ulceration, except from malignancy.

IV. *Idiopia.* Relation of component segments. The proximal end of the pancreatico-duodenal artery originates from the right gastro epiploic artery, the distal end originates from the jejunal artery or its branches. In general the proximal end is single. Ex arteria gastro-epiploica, the distal sion, a bifurcation, a loop—the "circle of the pancreatico duodenal artery," which receives the head of the pancreas.

Remarks. The pancreatic-duodenal artery, or what is designated the "duodenal circle," receives scant attention in anatomy text books of any language. Among the first and best illustrations of the pancreatico duodenal artery may be observed in Bourgery and Jacobs, 1839, plate 25, Tome, V. Jacobs, the artist of this magnificent colossal anatomy presents the pancreatico-duodenal artery with unicity, i. e., a single trunk at both its proximal (Ex gastro-epiploica dextra) and distal Ex arteria jejunalis origins, however, in the middle of its segments, the artery divides forming a circle, a loop, exactly similar to the "circle of the gastric artery," and this was frequently the condition I observed in 65 consecutive subjects. In the "circle of the pancreatico-duodenal artery," the des-

ignation I apply to it, one loop courses dorsal to the pancreatic head, the other arc of the circle ventral and similarly the "circle of the pancreatico-duodenal artery" supplies the ventral and dorsal walls of the duodenum. Should there be present an arteria hepatica accessoria (Ex arteria jejunalis) it courses dorsal to the pancreatic head and anastomoses with the dorsal segment of the "circle of the pancreatico-duodenal artery."

Presumably the general anatomic text books, assume the plan of drawing the pancreatico-duodenal artery schematically consisting of a single artery-arc with numerous lateral branches to supply duodenum and pancreas.

In the present state of pancreatico-duodenal surgery initiated 20 years ago by Senn, the foremost surgeon of the world, the pancreatico-duodenal artery or "circle" is of significant importance. If the pancreatic head be extirpated the pancreatic or duodenal circle or artery must be ligated at both proximal and distal ends, which would notably endanger the duodenum, not only to ulceration but to gangrene and this is exactly what occurs in extirpation of the pancreatic head in animals. The circulation of the duodenum and pancreas, from embryologic association, cannot be separated and hence we have proposed that the "duodenal circle" or arc together with the "pancreatic circle" or arc is the combined anastomotic circle or arc, which connects, unites, the coeliac axis with the jejunal artery—"gastro-enteronic circle"—(arcus gastro-intestinalis.

Conclusions Regarding the "Duodenal Circle."

Pancreatico-duodenal Artery.

The importance or significance of the pancreatico-duodenal artery or "duodenal circle" is its utility in the unlimited field of physiology and in the limited field of surgery as a guide.

The physician's duty is practically limited by the field of pathologic physiology.

Blood cures diesease.

The utility of the "inosculation circle" is to congest the peripherel viscus and to transport blood to a viscus or from one viscus to another.

The utility of the "duodenal circle" is to transport blood from the stomach (the "concentric gastric circles") to the duodenum (enteron).

The apparatus for producing hyperaemia is the inosculation circle. The means of functioning (sensation, absorption, secretion, peristalsis) the inosculating circle is by stimulating its automatic specialized periperal ganglia (Auerbach's and Billroth-Meissner's) with fluid, food, chemicals.

Rational therapeutics for the inosculating circle is *"Visceral drainage,"* which produces maximum blood volume in the inosculation circle and maximum visceral elimination.

Pancreatic Anastomotic Vascular Apparatus.

Pancreatic Anastomatic Vascular Apparatus.

Dissection. If one injects the coeliac axis and jejunal artery to maximum distention, especially in a youthful subject and subsequently dissects the arteries of the pancreas a rich anastomotic vascular apparatus becomes exposed which connects the branches of the coeliac axis with the jejunal artery.

This anastomotic vascular apparatus of the pancreas I have designated as the "pancreatic circle" or "arcus pancreaticus." As typical illustrations see figures (62), (64), (65).

The routes to expose the pancreas in order of utility, preferences are; 1st, through the omentum minus; 2nd, through the gastro-colic omentum; 3rd, through the meso-colon transversum.

Description of an object is useful but a picture does it a thousand times as

well. For a typical "pancreatic circle" or "arcus pancreaticus," or pancreatic anastomotic vascular apparatus I refer the reader to figures, (62), (64), (65) In figure (66) the hepatic, gastric and splenic arteries are solidly and compactly anastomosed, united with the jejunal artery. In fact the "pancreatic circle" emits a strong branch marked (a) to the jejunum. In figure (65) the "duodenal circle" or arcus duodenalis (pancreatico-duodenal artery) together with the "pancreatic circle" or "arcus pancreaticus" solidly and compactly anastomoses, connects the coeliac axis (gastrium) with the jejunal artery (enteron). In short the "duodenal circle" and "pancreatic circle" form a powerful gastro-intestinal arc.

The circulation of the duodenum ("duodenal circle") and pancreas ("pancreatic circle") is intimately and profoundly connected for physiologic purposes. The physiology of the duodenum (fluid and food) excits that of the pancreas by means of *secretin* transported from the duodenal muscosa through the "duodenal circle" and "pancreatic circle" to the pancreas, suggesting the initiating of pancreatic secretion, to the pancreas. Hence the profoundly anastomosed vascular apparatus associated with pancreas and duodenum. The pancreas is an evagiation, an outgrowth of the duodenum, hence the specialized peripheral ganglia of the "duodenal circle" and practically that of the "pancreatic circle" are similar. (Auerbach's and Billroth's-Meissner's.) The duodenal and pancreatic physiology is not only harmonized by compact vascular anastomosis but also by secretions (secretin).

Also the "duodenal circle" and the "pancreatic circle" are intimately and profoundly anastomosed, united, anatomically, absolutely, inseparable and perchance physiologically inseparable. Therefore whatever stimulates the specialized periperal ganglia of the "duodenal circle" will exercise the similar function over the specialized peripheral ganglia of the "pancreatic circle" and creaticae Parvae are numerous large and small arteries, irregular in number vice versa.

Arteries Forming the "Pancreatic Circle" or "Arcus Pancreaticus."

I. Branches from the Splenic Artery.

1. Rami Pacreatici, Arteria Pancreatica (media et Sinistra), or pan- and dimension, which pass from the distal border of the splenic artery vertically distilward to the body and tail of the pancreas. They are the middle and left pancreatic arteries. Some of the pancreatic arteries are relatively large for dimension of the pancreas. They form a solid and compact anastomatic network in the pancreas. The middle and left pancreatic arteries passing horizontally from left to right form an arch from the convexity of which pass dorsal and ventral branches to the pancreas.

2. *Pancreatica Magna.* (P. M. in illustrations) is the largest and longest of the pancreatic arteries. The pancreatica magna generally enters the tail of the pancreas, coursing within the pancreas from left to right slightly proximal and dorsal to the pancreatic duct, terminates by inosculating with the "duodenal circle" and frequently also with the jejunal artery. The pancreatica magna is one of the main arteries which produces a solid and compact anastomosis between the coeliac axis (stomach) and the jejunal artery, (enteron). I have termed the vascular anastomotic apparatus in the "pancreatic circle," or pancreas, the "arcus pancreaticus," see figures, (44), (45), (47), (48), (51), (56,) (58), (59), (62), (64), (65).

II. Branches from the Hepatic Artery.

1. Rami Pancreatici dextri, or right pancreatic branches consist of several (1 to 2), short, large, arteries, irregular in number and dimension, which pass from the distal border of the hepatic artery (trunk) vertically distalward to the head and neck of the pancreas. The right pancreatic branches anastomose

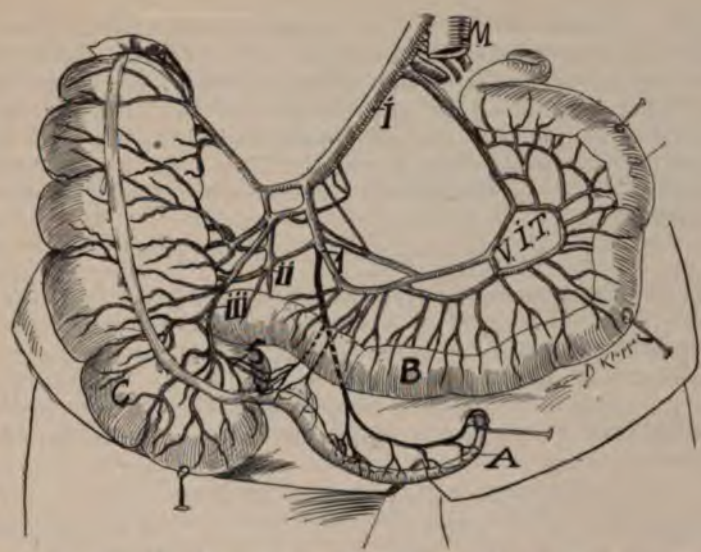


FIG. 21.—APPENDICULAR ARTERY, "ILEO-COLIC CIRCLE," VAS INTESTINI TERMINALE RECTUM," "ILEO-COLIC ARCHES."—VENTRAL VIEW.

Specimen injected, distended, dried and employed as a model by Zan D. Klopper.

1, arteria appendicularis. a single vessel of limited calibre arises from the right circumference of the ileo-colic circle, i. e., from the ileo-colic artery, and supplies the appendix with seventeen branches.

Though the ileo-colic circle in this subject was of limited dimensions, its mesentery within the circle is richly nourished by cross arteries. In this subject the ileo-colic circle is limited in dimensions from elongation of the jejunal artery.

The ileo-colic circle is formed by the proximal and distal union of the ileal and ileo-colic arteries.

The ileo-colic arches, nine in number, are varied in form, dimension and calibre of anastomotic vessels. They resemble the sigmoid arches, and present an isolated, independent apparatus anastomosed on the one hand to the colic arteries, and on the other hand with the enteronic arteries.

The ileo-colic circle, ileo-colic arches and appendicular arteries are intimately related.

The "straight terminal vessel" is of ample length for clamping or ligating without compromising the Meso colic or Mesenteronic arches. See section II., page 13, for more complete description.

solidly and compactly with the pancreatic branches from other sources. See figures (40), (43), (56), (57), (59), (61), (62), (64), (65).

III. Branches from the Gastric Artery.

Figures (63), (65) present an arterial branch passing from the gastric artery to the pancreas, anastomosing with the pancreatic branches from other sources.

IV. Branches from the Coeliac Axis.

Figures (30), (38), (40), (41), (43), (46), (51), (65) presents branches arising from the coeliac axis, passing to the pancreas to anastomose with the pancreatic branches from other sources.

V. Branches from the Aorta.

Figures (30), (59), (64) present branches passing from the aorta to the pancreas to anastomose with pancreatic branches from other sources.

VI. Branches from the "Duodenal Circle." (The Pancreatico-duodenal Artery.)

The general figures present numerous long and short, large and small branches, irregular in number and dimension, which pass from the pancreatico-

duodenal artery ("duodenal circle) to the head and neck of the pancreas, anastomosing with the pancreatic branches from other sources. The pancreatico-duodenal artery frequently bifurcates in its middle segment, forming an oval loop (the "circle of the pancreatico-duodenal artery"), which surrounds the head of the pancreas and emits pancreatic branches from its circumference—dorsal and ventral. The branches of the "duodenal circle" (pancreatico-duodenal artery) profoundly anastomose with the pancreatic branches from other sources.

VII. Branches from the Jejunal Artery.

1. The pancreatic branches of the jejunal artery arising from the proximal end of its trunk, pass to the pancreas, anastomosing with the pancreatic branches from other sources, see figures (56), (57), (58), (59), (62), (64).

2. The pancreatic branches arise from the *rami jejunales* or from the *branches of the jejunal artery,* pass to the pancreas, anastomosing with the pancreatic branches from other sources, see figures (38), (40), (43), (46), (51), (56), (59), (65).

VIII. Branches from the Ileocolic.

The pancreas may be supplied by a branch from the ileocolic, see figures (29), (41).

The numerous pancreatic arteries enter the pancreas from numerous points. The pancreatic arteries are not only relatively but absolutely of remarkable dimensions as regards the moderate dimensions of the pancreas. The pancreatico-duodenalis is the principle artery of the pancreas. It forms an intimate anastomosis with the pancreatica magna which transverses the central portion of the entire body and tail of the pancreas. Hence the branches which supply the pancreas and produce within a solid and compact anastomotic apparatus, a "pancreatic circle" or "arcus pancreaticus" arise, from (I.) hepatic, (II.) splenic, (III.) gastric, (IV.) ceoliac axis, (V.) pancreatico-duodenal ("duodenal circle"), (VI.), jejunal, (VII.), rami jejunales, (VIII.), aorta.

The branches from the above 8 sources enter the pancrease, solidly and compactly anastomosing, forming the "pancreatic circle," "arcus pancreaticus," which combined with the "duodenal circle" solidly unite the coeliac axis (stomach) with the jejunal artery (enteron) and we may term the combination. "Arcus Gastricus Intestinalis."

Surgery of the pancreas presents dangerously bloody results, and on account of it compact anastomosis it is a bold surgeon who will sever many of its arteries.

Conclusions Regarding the "Pancreatic Circle" and the "Duodenal Circle"

As the "pancreatic circle" and "duodenal circle" are solidly, compactly and inseparably connected anatomically and physiologically, conclusions regarding the one should be practically applicable to the other.

The specialized peripheral ganglia of the "doudenal circle" are "Auerbach's and Billroth-Meissner's plexuses.

Recent physiologic investigating by Starling and others would indicate that the stimulation of the "Duodenal circle" (i. e., the exciting of its specialized peripheral ganglia, by fluid, food and medicaments) excites the specialized peripheral ganglia of the "Pancreatic circle" inducing the pancreas to functionate (secrete). For example fluid and food on the duodenal muscosa induces the production of a substance known as *secretin* which is transported in the blood to the pancreas, warning it to act. The secretion is formed by exciting the specialized peripheral ganglia of the "duodenal circle," and is conducted by the blood through the "pancreatic circle," exciting its specialized peripheral ganglia which influences pancreatic secretion.

By means of the "duodenal circle" together with the "pancreatic circle,"

as soon as food arives in the duodenum the general blood current is directed from the coeliac axis (stomach) to the enteron and pancreas, inducing ample secretions for digestive purposes. The stomach and liver, the duodenum and pancreas are ruled by a delicately balanced nervous apparatus—abdominal brain with its subordinate ganglia, as well as the harmonization produced by duodenal and pancreatic secretions, i. e., chemical stimulation (harmones) plays a role. See figures—illustrating the delicately ordered nerve apparatus located in the proximal abdomen. The objects of the inosculating circles "duodenal circle" and "pancreatic circle" is to control blood volume and current, and to direct it to localities of required physiologic activity, to concentrate blood volume for increased function (sensation, absorption, secretion, peristalsis).

When the gastrium is evacuated no stimulus remains to excite the specialized peripheral ganglia of the "cencentric gastric circles." Therefore when the food leaves the stomach it invades the new territory—the duodenum—where it stimulates the specialized peripheral ganglia of the "duodenal circle" and "pancreatic circle," not only robbing the blood from the "concentric gastric circles," but rapidly engorging, congesting, the "pancreatic circle" and "duodenal circle," exciting duodenal, pancreatic and hepatic secretions for digestive purposes. The "duodenal circle" and "pancreatic circle" is for the purpose of utilizing rapid transportation of blood volume from gastrium to enteron.

The following propositions apply to the combined "pancreatic circle" and "duodenal circle."

Blood cures disease.

The apparatus for executing hyperaemia is the inosculating vascular circle.

The means of functionating the inosculating vascular circle is the stimulating its specialized peripheral ganglia (Auerbach's and Billroth-Meissner's).

The chief rational therapeutics for the inosculating vascular circle is VISCERAL DRAINAGE, which produces maximum blood volume and maximum visceral elimination.

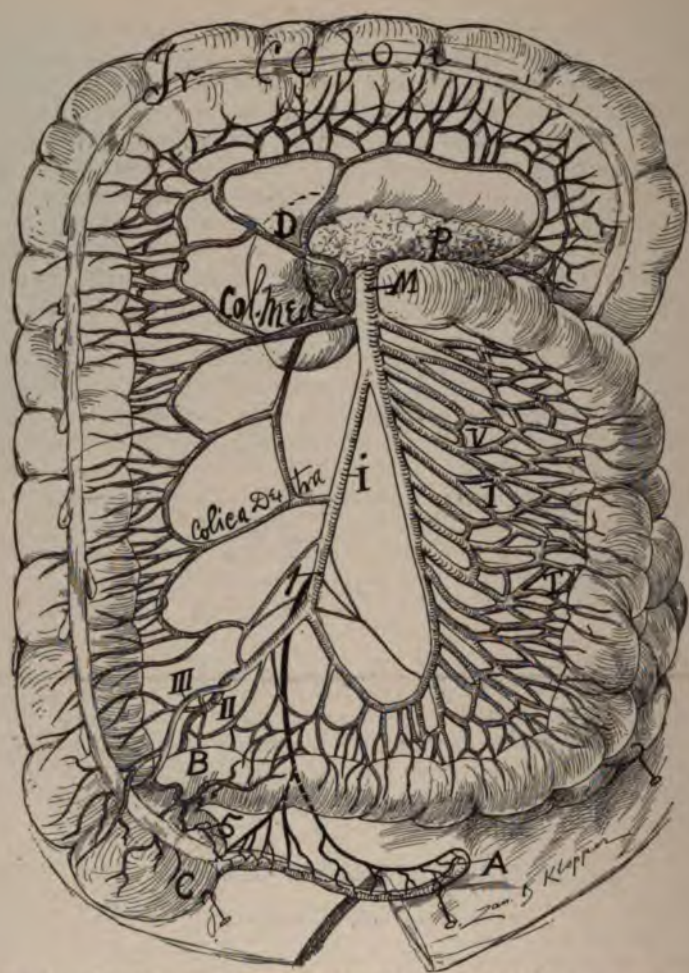
"GASTRO-ENTERONIC CIRCLE."

Arcus Gastricus Intestinalis.

Gastro-Intestinal Arc.

The anastomotic apparatus between the coeliac axis and proximal mesenteric artery consists of: 1, arcus duodenalis; 2, arcus pancreatis arc; 3, arcus gastricus intestini tenuis, gastro-enteronic arc; 4, arcus gastricus colicus.

In this article I wish to present what I shall term the "gastro-enteronic circle" or *Arcus gastricus intestinalis,* or the vascular anastomotic appparatus between the coeliac axis and the proximal mesenteric artery. The chief viscera through which the anastomosis between the coeliac axis and the proximal mesenteric artery is accomplished are the duodenum and pancreas. In other words, the anastomotic vascular apparatus between the coelic axis and proximal mesenteric artery lies chiefly on the surface and imbedded in the parenchyma of the pancreas and duodenum. The duodenum is the actual line of visceral connection between the gastrium and intestines, yet the pancreas shares largely even in the arcus duodenalis and its numerous additional anastomotic vascular arches and entitles it to a dignified position in the anastomotic apparatus, between the coeliac axis and the proximal mesenteric artery or in the arcus gastricus intestinalis. Arcus pancreaticus, or the anastomotic apparatus located between the coeliac axis and proximal mesenteric artery, i. e., the jejunal artery) possesses marked variation of dimension, anatomic construction, compactness of meshwork, location, and volume of main anastomotic arteries. In fact, the profound vascularity of the pancreas with its rich anastomotic meshwork, enmeshed



APPENDICULAR ARTERY, "ILEOCOLIC CIRCLE," "ILEOCOLIC ARTERIES," "MAJOR MESOCOLIC CIRCLES," "ENTERO-COLIC CIRCLE," "STRAIGHT TERMINAL VESSEL." VENTRAL VIEW.

Fig. 22. Appendicular artery, a single vessel of considerable dimension, originates from the "ileocolic circle."

A large artery is not compromised with facility by the mesoappendix during inflammatory processes. For more complete description see section II., page 13.

and embedded within its parenchyma and on its surface, will challenge the skill and boldness of the surgeon during surgical procedures. I shall assume that the "gastro-enteronic circle" or the arcus gastricus intestinalis is composed of four components, viz.: (a), arcus duodenalis; (b), arcus pancreaticus; (c), arcus gastricus intestini tenuis; (d), arcus colicus. The "gastro-enteronic circle" or arcus gastricus intestinalis is an extensive vascular apparatus and not only includes the anastomoses of the gastrium and enteron, but also that of the colon, duodenum and pancreas (see figures 30, 42, 45, 47, 50). Hence the arcus gastricus intestinalis includes and comprehends the arcus gastricus colicus, arcus duodenalis and arcus pancreaticus. The arcus gastricus intestinalis demonstrates that the gastrium, enteron, colon, duodenum and pancreas are solidly and compactly anastomosed.

In short, one can inject the entire intestinal tract by forcing the injecting materials in any one of its branches. Injection of any one of the three segments of the tractus intestinalis—gastrium, enteron, colon—will inject the remaining two. The Swiss anatomist, Dr. Abey, in 1871, suggested that the arch which I am terming "gastro-enteronic circle" or arcus gastricus intestinalis be called the arcus duodenalis or duodenal arch comprising but a limited portion of the arcus gastricus intestinalis, hence I discard the term arcus duodenalis for the more comprehensive one, arcus gastricus intestinalis, which includes a vast anastomotic apparatus belonging to the tractus intestinaiis and pancreas. The following list of arteries will indicate its extent, composition and utility.

GASTRO-ENTERONIC CIRCLE.

Arcus Gastricus Intestinalis.

Anastomotic apparatus between the coeliac axis and the proximal mesenteric artery.

Arteria gastrica.
- (a), rami œsophagei.
- (b), ramus hepaticus.
- (c), rami gastricae (ventral et dorsal).
- (d), ramus pyloricus (ramus anastomoticus).
- Arcus arteriosus gastricus minor.
- Arcus gastricus proximal.
- Proximal concentric gastric circle.

Arteria hepatica.
- (a), ramus hepaticus dexter.
- (b) ramus hepaticus sinister.
- (c), rami pylorici (dorsal et ventral).
- (d), arteria gastro-duodenalis.
- (e), rami caput pancreaticus.
- (f), rami duodenalis proximal.
- (g), arteria pancreatico-duodenalis proximal.
- (h), arteria cystica.
- (i), arteria hepatica mesenterica proximal (see fig. 36).
- (j), arteria gastro-epiploica dextra (ramus anastomoticus).
- Arcus arteriosus gastricus major.
- Arcus gastricus distal.
- Distal concentric gastric circle.

Arteria lienalis.
- (a), rami pancreatici (pancreaticae parvae).
- (b), arteriae gastricae breves.
- (c), arteria epiploica sinistra (ramus anastomoticus).
- (d), arteria pancreatico-duodenalis distal.
- (e), arteria pancreatica magna.
- (f), arteria pancreatica colica (see fig. 58).
- (g), arteria splenica colica (see fig. 45).
- (h), rami proprii lienis.
- Arcus arteriosus gastricus major.
- Arcus gastricus distal.
- Distal concentric gastric circle.

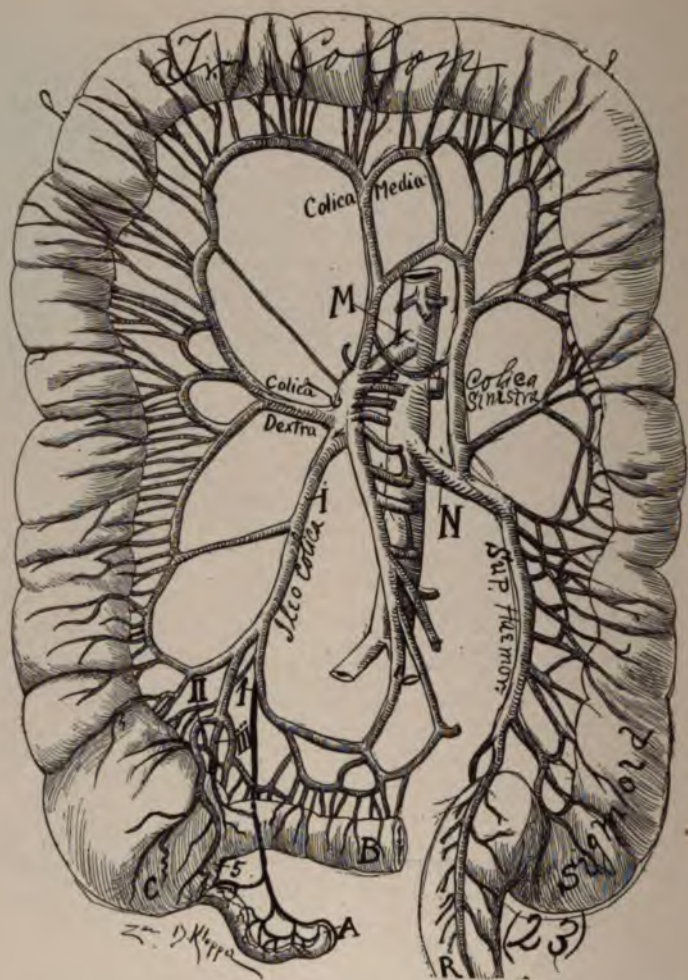
The arteria lienalis, arteria hepatica and arteria gastrica solidly and compactly anastomose and form the "*concentric gastric circles,*" composed of:

(a), Arcus gastricus proximal (gastro-hepatic circle) and Arcus gastricus distal (splenohepatic circle).

(b), Arteria coeliaca colica (fig. 30).

(c.), Arteria coeliaca mesenterica proximal (figs. 38, 41, 43, 46, 50, 51, 58).

(d), Arteria pancreatica mesenterica proximal (figs. 30, 38, 40, 41, 43, 44, 45, 47, 50, 51 58).



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL." "ETEROCOLIC CIRCLE," "ILEAL ARTERY." MAJOR MESOCOLIC CIRCLES."

Fig. 23. Specimen injected, dissected, dried and employed as a model by the artist, Zan D. Klopper. Ventral view. A, appendix. B, ileum. C, cecum. I, arteria ileocolica. II, arteria ileocoecalis dorsalis. III, arteria ileocoecalis ventralis.

1, arteria appendicularis, a single vessel of considerable dimension, arises from the right circumference of the ileocolic circle, i. e., the ileocolic artery. The appendicular artery emits 5 branches to the appendix. 5, is the anastomotic branch between the cecum and appendix. Meso appendicular arches exist.

"Ileocolic circle" is formed by the bifurcation of the arteria mesenterica proximal into the ileocolic and ileal arteries and completed by their distal anastomosis. The signification of the ileocolic circle is that it generally emits the arteria appendicularis which immortalizes it among vascular circles.

It is a typical inosculation circle, possessing peripheral viscus and automatic peripheral ganglia. The function of which is to dilate the "inosculation circle."

The ileocolic arches number 4 and are composed of the combined anastomosis of the arteria ileocoecalis dorsalis et ventralis. The "ileocolic arches" are a primordial vascular landmark. They are located in the ileocolic angle and attending the cecum and appendix.

"Vas intestini terminale rectum" or "straight terminal vessel of the intestine" extending from the mesenteronic and mesocolic arches to the border of the mesenteron or colon is of

ample length (½ to 2 inches) for clamping or ligation without molesting the mesenteronic or meseocolic arches and thus avoiding the intestine to the jeopardy of ulceration and gangrene.

The ileal artery extends from the bifurcation of the jejunal artery to its distal anastomosis with the leocolic artery. The ileal artery emits branches to the ileum which is so limited in blood supply at its distal end that it is liable to ulceration and perforation, and the ileocolic artery the right circumference of the ileocolic circle.

The "enterocolic circle" (Riolan-Haller arch) is formed by the transverse colic artery with the left colic artery and is from multiple arteries and consequent arches solidly and compactly anastomosed.

The enteronic circle" joins the blood current of the enteron with the colon and transports blood volume from the enteron to the colon as required for function.

There are 4 "Major mesocolic circles," right distal, (Reno-duodenal field) right proximal and left proximal and left distal (left renal field).

There are 4 "Major mesocolic arches" in this illustration because an accessory transverse colic artery (Waldeyer's) exists.

For more description see section II, page ——.

Arteria Gastrica.

The arteria gastrica begins in the coeliac axis and ends in the arteria hepatica, producing the proximal concentric gastric circle. It emits:

(a), the *rami oesophagei* to the œsophagus (anastomosing with the thoracic arteries);

(b), the *ramus hepaticus* to the liver;

(c), the *rami gastrici* (dorsal and ventral) to the dorsal and ventral surface of the stomach;

(d), the *ramus pyloricus* (the ramus anastomoticus), which completes the proximal gastric arch. Hence, by the anastomosis of the right and left gastric arteries there is formed the *arcus gastricus proximal*, or the *arcus arteriosus gastricus minor*—a solid and compact anastomosis, which I shall term the *proximal "concentric gastric circle."*

Arteria Hepatica.

The hepatic artery arises from the coeliae axis and terminates in the liver. It emits:

(a), *rami pancreaticae* to the caput pancreaticus;

(b), *rami pylorici* (proximal and distal), supplying the pylorus;

(c), *gastro-duodenalis*, which divides into: (d), *ramus pancreatico-duodenalis (proximal)*, which sends branches to the duodenum and pancreas and which also anastomoses with

(e), the *ramus pancreatico-duodenalis (distal)*, constituting the arcus duodenalis;

(f), the *gastro-epiploica dextra*, which courses distalward and leftward along the major curvature of the stomach and omentum majus and anastomosing with the (g) *gastro-epiploica sinistra*, which completes the *arcus gastricus distal*, or arcus arteriosus gastricus major—a compact and solid anastomosis. This is the distal "concentric circle." The anastomotic apparatus between the coeliac axis and proximal mesenteric artery is additionally solidified by:

(h), the *arteria cystica*, which richly supplies the cholecyst, and

(i), perchance by the arteria hepatica mesentérica proximal, which may arise from the proximal mesenteric artery and pass to the liver (see fig. 36).

Arteria Lienalis.

The artery arises from the coeliac axis and ends in the spleen. It emits:

(a), rami pancreatici (pancreatici parvae), 4 to 6 major and minor branches, in regular order, to the corpus and cauda pancreaticus. These branches transverse the surface of the parenchyma of the pancreas and anas-

tomose especially with the branches of the *gastro-epiploica dextra* and *pancretica parva.*

(b), *arteria gastricae breves,* 3 to 6 in number, originating from the trunk and terminal branch of the splenic artery, course ventralward and rightward to the gastric fundus, inosculating solidly and completely with the gastric branches, especially those of the epiploica sinistra.

(c), *pancreatica magna,* a strong branch which is emitted from the arteria lienalis adjacent to the cauda pancreatica, courses from right to left in the dorsal parenchyma of the pancreas, parallel with the ductus pancreaticus, richly inosculating with branches from the pancreatico-duodenalis and proximal mesenteric artery.

(d), *arteria gastro-epiploica sinistra* (ramus anastomoticus) arises from the left of the arteria splenica, courses ventral to the cauda pancreatica, along the major gastric curvature, from left to right between the blades of the omentum majus to inosculate with the arteria gastro-epiploica dextra. The gastro-epiploica sinistra emits branches to the dorsal and ventral gastric surfaces which are solidly anastomosed to other gastric branches, and also emits branches to the omentum majus which may anastomose with the arcus transverseus colicus. By means of the gastro-epiploica (dextra and sinistra) coursing along the major gastric curvature, constituting the arcus gastricus distal, and the gastric artery (right and left inosculated), coursing along the minor gastric curvature, constituting the arcus gastricus proximal, there are presented two *"concentric gastric circles"* which anastomose the gastrium solidly and compactly to the coeliac axis through its three primary branches—gastric, splenic, hepatic.

Arteria Pancreatico-Duodenalis Distal.

The smallest of the jejunal arteries arises from the right dorsal or left wall of the proximal menenteric artery and courses rightward and proximalward between the duodenum and caput pancreatica, inosculating with the pancreatico-duodenalis proximal, and emits numerous branches to the duodenum and pancreas which inosculate with the meshwork of branches within the pancreas. It anastomoses like a stovepipe with the arteria pancreatico-proximal, completing the duodenal arch—arcus duodenalis.

Arteria pancreatico-duodenalis proximal, which courses between the caput pancreatica and duodenum, inosculating with the pancreatico-duodenalis distal, ending in numerous branches of the caput pancreatica and duodenum. The branches passing to the pancreas inosculate solidly and compactly with the network within the pancreas. The pancreatico-duodenalis proximal (and distal) is frequently double—a dorsal and ventral—thus enhancing the compactness and solidarity of the anastimotic apparatus between the coeliac axis and proximal mesenteric artery.

The solid, abundant, compact stovepipe method of anastomosis of the arteria pancreatico-duodenalis proximal and distal is of marked dimension. It should be termed the arteria pancreatico-duodenalis. It is frequently duplicate (a dorsal and a ventral) and follows the concavity of the duodenum, emitting multiple branches to both pancreas and doudenum. It may rationally be demonstrated as an arcus duodenalis or duodenal arch. It forms a significant part of the "gastro-enteronic circle" or arcus gastricus intestinalis, or the anastomotic apparatus between the coeliac axis and proximal mesenteric artery.

Arteria pancreatica colica (see figs. 50, 58).

The arteria pancreatica colica et omentalis arises from the anastomotic meshwork located on the dorsal pancreatic surface, and within its parenchyma, and courses between the blades of the mesocolon transversum to the arcus transversus colicus and colon. The pancreatico-colic and omentel artery originally

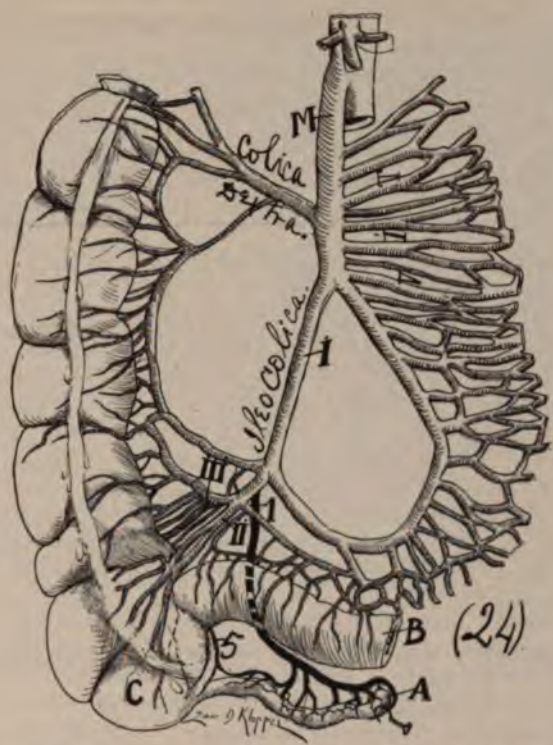


FIG. 24.—APPENDICULAR ARTERY. "ILEO-COLIC CIRCLE," ILEO-COLIC ARCHES." "STRAIGHT VESSEL," "RIGHT DISTAL MAJOR MESOCOLIC CIRCLE."

Ventral view. A, appendix. B, ileum. C, cecum (non-symmetrical). I, arteria ileo-colica. II, arteria ileo-cecalis dorsalis. III, arteria ileo-cecalis ventralis. M, arteria mesenterica proximal.

1, arteria appendicularis, a single vessel of considerable dimension, arises from the right circumference of the ileo-colic circle, or from a cross-bar of the circle.

The appendicular artery emits twelve branches to the appendix.

It is a strong artery and would resist compromization from meso-appendicitis.

Ileo-colic circle, a typical "inosculation circle" formed by the bifurcation of the jejunal artery into ileal and ileo-colic arteries and completed by their distal anastomosis, is crossed by the appendicular artery.

Ileo-colic arches, six in number. The distension of the specimen distorted the blood apparatus.

Appendix is located parallel with the distal ileum. For more complete explanation see section II., page 13.

arises from the splenic, solidifying the arcus gastricus colicus. The arteria pancreatica colica is a direct primary arch connecting the colon to the pancreas or to the anastomotic apparatus located between the gastrium and colon, making doubly sure general intestinal anastomosis.

Arteria splenica colica (see fig 45) arises from the arteria lienalis and courses between the blades of the mesocolon transverum to the transverse meocolic arch and colon, reinforcing the arcus gastricus intestinalis. This artery, a primary arch, connects directly the splenic artery with that of the colon transversum, additionally strengthening the gastro-intestinal arc. The arteria gastrica, arteria lienalis and arteria hepatica solidly, compactly anastomose and form the concentric gastric circle, composed of the arcus gastricus proximal (gastro-hepatic circle), and arcus gastricus distal (gastro-spleno-hepatic circle).

The anastomosis constitutes the arcus arteriosus gastricus major and arcus arcus arteriosus gastricus minor.

Arteria coeliaca colica connects the coeliac axis directly with the arcus colica transversus (see fig. 30). This lends practical strength to the arcus gastricus intestinalis. In this subject the coeliac axis is directly connected with the Riolin-Haller arch, and the gastro-intestinal arch is solid and compact. It is a primary vascular arch between the arterial trunk of the gastrium and a transverse colic arch, additionally fortifying the gastro-intestinal anastomotic apparatus.

Arteria coelica mesenterica proximal connects directly the coelic axis with the proximal mesenteric artery (see figs. 38, 41, 43, 46, 50, 51, 58). These vessels, connecting directly the proximal mesenteric artery and coeliac axis, strongly fortifies the solidarity and compactness of the arcus gastricus intestinalis or gastro-intestinal arch. It is named similarly to the arteria uterina ovarica. It is a primary vascular arch between the primary arterial trunk of the gastrium and primary arterial trunk of the intestine. It is of variable dimension (length and diameter). For this primary direct vascular connecting arc between the coeliac axis and proximal mesenteric artery see figs. 38, 41, 43, 46, 50, 51, 58. Thirty per cent of subjects observed for this "primary arcus coelicus mesentericus proximal" presented it distinctly. A similar primary arc may be observed between the proximal and distal mesenteric arteries (see figs. 23, 27, 28, 30, 38, 42, 45, 50, 54, 58).

Arteria pancreatica mesenterica proximal arises from the proximal mesenteric artery and passes to the pancreas, inosculating with the meshwork of arteries on the pancreatic surface and within its substance (see figs. 30, 38, 40, 41, 43, 44, 45, 47, 50, 51, 58). This frequent connection of the proximal mesenteric arteries and compact pancreatic anastomosis with the pancreatic branches, powerfully fortifies the compactness and solidarity of the "gastro-enteronic circle" or arcus gastricus intestinalis. The pancreatic anastomosis forms the arcus pancreaticus. The pancreatic anastomosis is second in importance only to the arcus duodenalis. The arteria pancreatica mesenterica proximal is a powerful element in adding compactness, solidarity, richness and dimension to the gastro-intestinal anastomotic apparatus.

Arteria colica mesenterica proximal arises, as may be observed in fig. 50, from the proximal mesenteric artery and passes to the transverse colon, thus solidifying the gastro-intestinal anatsomotic apparatus. It strengthens the arcus gastricus colicus.

The arcus gastricus intestinalis is composed of four factors, viz.:

Anastomosis or the Arcus Gastricus Intestinalis.

Conclusions As Regards the "Gastro-Enteronic Circle" Gastro-Intestinal Arc.

"Gastro-enteronic circle." / Arcus gastricus intestinalis.

1. arcus duodenalis.
2. arcus pancreaticus.
3. arcus gastricus intestini tenuis (gastro-enteronic circle).
4. arcus gastricus colicus.

These four arcs anastomose, unite the gastrium to the enteron and colon, producing a distinct single vascular unit of the tractus intestinalis.

The anastomotic apparatus between the gastrium and intestine "gastro-enteronic circle"—arcus gastricus intestinalis—is located between the coelic axis and proximal mesenteric artery.

The gastro-intestinal circle is practically associated with two viscera, viz.: (a), the *duodenum* with its solid, compact, powerful arcus duodenalis (composed practically of the anastomosing arteria pancreatico-duodenalis (proximal and distal)—). This is the duodenal circle or arch figure (56)—); (b), the *pan-*

creas, on the surface and in the parenchyma of which is located a compact, solid, abundant arterial anastomosis derived chiefly from the arteria coeliaca and proximal arteria mesenterica—which I shall term the "pancreatic-circle" or arcus pancreaticus. This is the pancreatic arch (figure (56)—); (c), the arcus gastricus intestini tenius consists of arteries uniting the cœliac axis or its branches to the branches of the proximal mesenteric artery. It is the gastro-enteronic arch (see figures (38), (39), (41), (43), (46), (50), (51), (56),—); (d), the arcus gastricus colicus consists of arteries connecting the gastrium to the colon. It consists of arteries connecting the cœliac axis to the colonic arches (see figures (30), (42), (45), (50), (56)—). The methods of routes of anastomoses in the "gastro-enteronic circle" or arcus gastricus intestinalis is direct and indirect. The utility of the solidarity, compactness and abundance of anastomoses in the tractus intestinalis between the gastrium, enteron and colon (by its four arcs or circles—arcus duodenalis, arcus pancreaticus, arcus gastricus, intestini tenuis (gastroenteronic arc), and arcus gastricus colicus) is to direct required blood volume to required segments during digestion. The "gastro-enteronic circle" arcus gastricus intestinalis produces a single vascular unit of the tractus intestinalis exactly similar, as the tractus genitalis is rendered a single vascular unit by means of the genital vascular circle—the arteria uterina ovarica. In the uterus, or oviducts, a gestating ovum, a neoplasm will entice through compact, solid and rich genital anastomoses a marked volume of blood to a single point and it is blood that initiates, sustains and subsides marked function.

THE "STRAIGHT TERMINAL VESSEL OF THE INTESTINE."

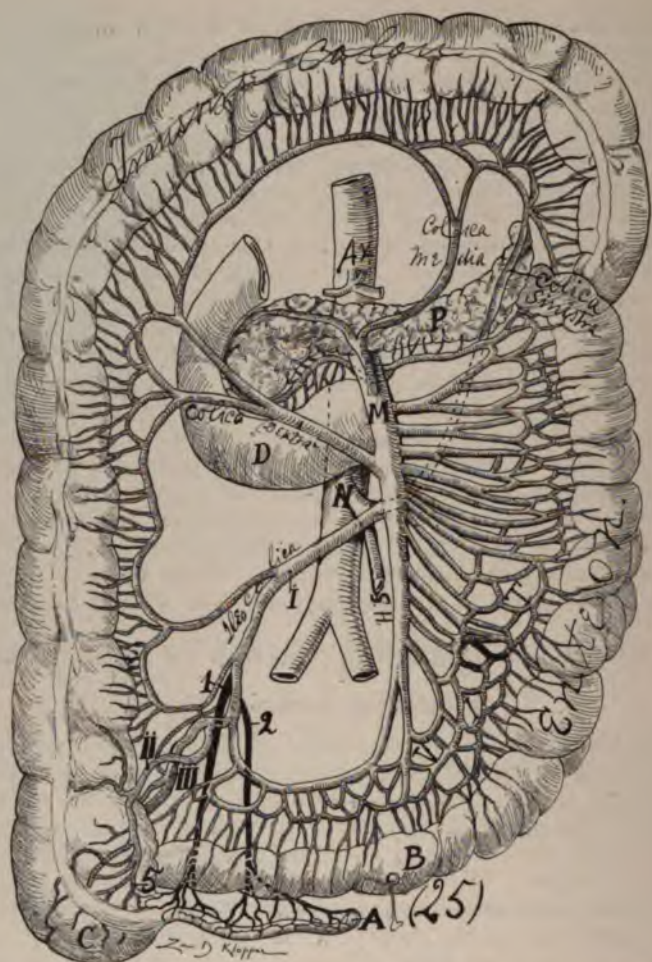
"Vas Intestini Terminale Rectum."

While dissecting the tractus vascularis of the tractus intestinalis in 65 subjects I was convinced that insufficient attention has been directed to a certain kind of "straight vessel" located between the "mesenteric arch" and the border of the intestine. The nomenclature I have adopted is the "straight terminal vessel of the intestine," and I consider it of sufficient dignity to become designated as a *vascular landmark*. The "straight vessel" is intimately related to intestinal resection, laterial anostomosis and end-to-end union. It is especially important in surgical procedures in the region of the "enterocolic circle" or the Riolan Haller arch. If it be properly managed during surgical procedures on the intestinal tract gangrene or endo intestinal ulceration may be averted.

The Latin nomenclature of this vessel, to which all anatomy submits, I propose is *vas intestini terminale rectum*. The time is propitious, not only to establish a correct onomatology, but to establish a correct onomatology as regards the tractus vascularis in intestinal surgery. The chief factor in intestinal surgery is the proper management of the blood vessels.

Correct and exact nomenclature are the absolute steps in mental progress. Anatomy is reigned by Latin and modern surgery by Greek nomenclature. The Greek language was cultivated twelve hundred years, and the Latin language almost the same length of time. For exact and accurate comprehension no selection of nomenclature can improve on the Latin and Greek speech. It is said that the greatness of Haeckel is chiefly manifest in his masterly selection of correct and comprehensive nomenclature. Erroneous onomatology has confused the profession for centuries. Ages and devoted lives have been wasted on absurd "isms" and "pathies" unnamed, indefinable, with diffuse nomenclature.

Intestinal surgery is in a state of rapid progress of useful development. It is no more a pioneer field and yet, as one reads of repeated failures from gangrene and ulceration of the intestinal mucosa, it is evident that a general, accurate knowledge of the proper technique in the management of the blood vessels during surgical procedure prevails not. Recently I read of seven



APPENDICULAR ARTERY, "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "ENTEROCOLIC CIRCLE." "STRAIGHT TERMINAL VESSEL."

Fig. 25. Ventral view. Arteria appendicularis, a primary and secondary vessel of considerable dimension. Originate from the "oleocolic circle." It emits 17 branches to the appendix. Ileocolic arches, 3. For complete description see section II., page 13.

fatalities following surgical procedures on the tractus intestinalis, due to gangrene. The blood supply was mismanaged.

The proper management of the blood supply in intestinal surgery practically depends on a correct knowledge of the anatomy of the "*straight terminal vessel of the intestine*" or "*vas intestini terminale rectum.*" My subject is intestinal resection; however, my theme is the "straight terminal vessel of the intestine."

The personal dissection of 65 subjects in reference to this "straight vessel" has convinced me of its significant utility and also of its significant neglect in intestinal surgery. I will attempt to describe and illustrate by original dissections this important vascular landmark in the tractus intestinalis which I designate "straight terminal vessel of the intestine," or "vas intestini terminale rectum."

The arrangement of the vascular apparatus to the tractus intestinalis consists of: First, trunk; second, arch; third, "straight terminal vessel." Number

3 is the theme of this paper. So far I have found no literature on the subject; hence the description here presented is entirely original from my own personal dissections, experimental labors on dogs and clinical hospital work.

Vas intestini terminale rectum or the straight terminal vessel of the intestine is located at the mesenterial border of the enteron and colon. It extends from the mesenterial arch to the intestinal wall. The signification of this straight terminal vessel is evident in its relation to the clamp ligature or suture in surgical procedures. The terminal straight vessels vary in number, dimensions (length and diameter) at different segments of the intestinal tract. First, the straight terminal intestinal vessel attends the enteron in maximum number and dimension (length and diameter); second, the straight terminal intestinal vessel next attends the colon (cœcum, right colon, transverse colon, left colon) with maximum dimension (length and diameter), however, in diminished number; third, the straight terminal intestinal vessel attends the sigmoid with minimum dimension (length and diameter), however, with increased number. The "straight terminal vessel" of the intestine courses practically parallel. They may attend the enteron in sufficient numbers and dimensions to present the appearance of a solid bed of parallel cords. One can count frequently six "straight vessels" to the inch in the enteron, and perhaps four to the inch in the colon.

The "straight vessels" to the enteron are uniform and similar. The "straight vessels" to the colon consist of two kinds, viz.: (a), a *"long, straight terminal vessel,"* which, no doubt, was originally intended to nourish, not only the colon, but the appendix epiploicus. It extends to the distal border of the colon (i. e., the side opposite the mesocolic attachment) and anastomoses with its opposite fellow. Perhaps 25 per cent. or one-fourth of the "straight terminal vessels of the colon" belong to this "long" class. (b), There is a *"short, straight terminal vessel"* which extends from the mesenteric arch to the colonic border. It merely supplies the dorsal and ventral colonic wall It does not extend to the appendix epiploicus. Perhaps 75 per cent. or three-fourths of the "straight terminal vessels of the colon" belong to this "short" class.

Frequently the mesenterical vascular arches may lie in contact with the intestinal ventral, dorsal (lateral) border, lending the appearance that the straight terminal vessel of the intestine is absent. (See Fig. 38, 37, 32, 43, 41, 40 47, 42, 31, 30.) However, the straight terminal vessel of the intestine is practically constant and of sufficient length to apply clamps, ligature or suture at a safe distance from the mesenterial arch. When in doubt as to the presence of the vas intestini terminale rectum or straight terminal vessel of the intestine, liberate the intestinal segments by slight blunt dissection and place the mesentery on tension, whence the "straight" vessel will doubtless become amply evident for surgical procedure. So far as I am aware, this introduces new anatomical nomenclature, yet I do not hesitate, because; first, the term (vas intestini terminale rectum or straight terminal vessels of the intestine) is appropriate; second, the progress of surgery demands precise and exact onomatology; third, the "straight" vessel of the intestine is of sufficient signification to be designated as a vascular landmark of the intestine.

The original illustrations accompanying the text from original dissections will explain the views a thousand fold better than words.

CHAPTER II.

ARTERIA MESENTERICA PROXIMAL.

THE PROXIMAL MESENTERIC ARTERY

(SUPERIOR MESENTERIC ARTERY)

Composed of the Jejunal Artery and Ileal Artery.

Dissection.—Expose the viscera by a crucial abdominal incision. Reflect the transverse colon proximalward, the right colon rightward and the enteron leftward. Remove the distal blade of the transverse mesocolon, the left blade of the right mesocolon and the right blade of the mesenteron with the mesenteric glands and the distribution of the distal mesenteric artery is exposed.

Distribution.—The proximal mesenteric artery, the maximum branch of the abdominal aorta, supplies the enteron (except the duodenum), and proximal half of the colon (appendix, cecum, right and half of the transverse colon).

Segments of the Proximal Mesenteric Artery.—I shall, for the convenience of description and practical utility, divide the proximal mesenteric artery into the following segments, namely: (I.) *Jejunal artery* and *Ileal artery;* (II.), *Branches;* (III.) *Arches;* (IV.) *Straight Terminal Vessel.*

The proximal mesenteric artery supplies two territories, namely: (a) that of the enteron (duodenum, jejunum and ileum); (b) that of the colon (appendix, cecum, right colon and half of the transverse colon).

SEGMENTS OF THE PROXIMAL MESENTERIC ARTERY

I.—Trunk, Jejunal Artery	II.—Branches	III.—Arches	IV.—Straight Terminal Vessel.
Bifurcates into ileocolic and ileal arteries to form the "ileocolic circle.	1—Inconstant branches (pancreatic vascular apparatus). 2—Pancreatic oduodenalis (distal and proximal) 3—Rami jejunales. 4—Rami ilei. 5—Ileocolica. 6—Colica dextra. 7—Colica transversa. 8—Colica transversa accessoria.	Mesenteronic Mesocolic "Ileocolic Circle."	Vas intestini terminale rectum. Ramuli intestinales.

THE JEJUNAL ARTERY OR

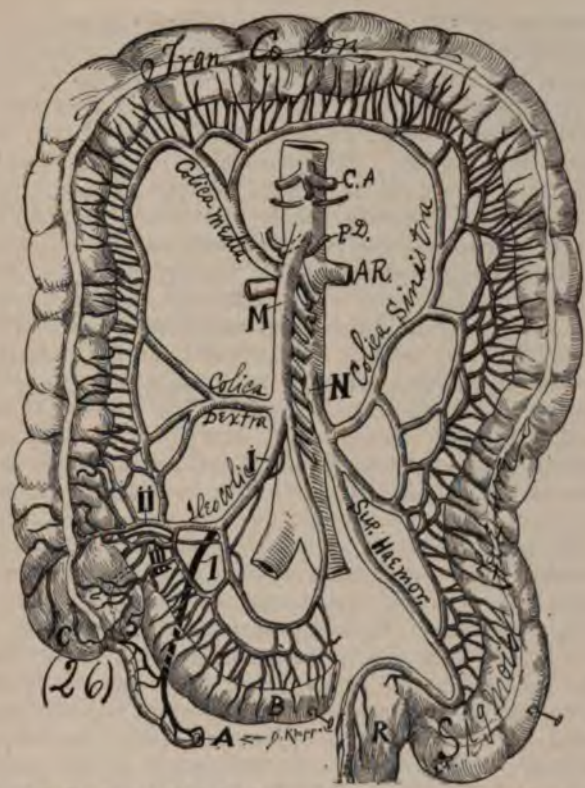
I. The Trunk of the Proximal Mesenteric Artery.

(*Truncus Arteria Mesenterica Proximal.*)

The jejunal artery extends from the pancreas to the ileocolic circle.

Origin.—The jejunal artery arises from the ventral surface of the aorta one-half an inch distal to the celiac axis, dorsal to the pancreas and splenic vein. Its origin is on a level with the junction of the first and second lumbar vertebrae.

Termination.—The jejunal artery terminates at its major bifurcation to form the "ileocolic circle." The termination of the jejunal artery is in the



APPENDICULAR ARTERY, "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "ENTERONIC CIRCLE." "MAJOR MESOCOLIC CIRCLE." "STRAIGHT TERMINAL VESSEL."

Fig. 26. Ventral view. Note the powerful single appendiculary artery. It emits 8 branches to the appendix.

"Ileocolic arches," 6. Enterocolic circle or Riolan-Haller arch" is of marked dimension. For more complete description see section II., page 13.

region of the origin of the distal mesenteric artery (one and one-half inches proximal to the aortic bifurcation), or at the junction of the second and third lumbar vertebrae. In thirty-two subjects the jejunal artery bifurcated fifty per cent. distal, twenty-eight per cent. proximal and twenty-two per cent. on a level with origin of the distal mesenteric artery or junction of the third and fourth lumbar vertebrae. Hence, syntopically, the origin of the jejunal artery is dorsal to the pancreas and splenic vein and ventral to the transverse duodenum and left renal vein, while the termination is its major bifurcation into ileocolic and ileal arteries to form the "ileocolic circle" which is practically at the origin of the distal mesenteric artery. Skeletopically the jejunal artery begins at the junction of the second and third lumbar and ends at the junction of the third and fourth lumbar vertebrae.

The distal termination of the jejunal artery into the arteria ileocolica and arteria ilei represent a primordial division to nourish ileum and cecum as well as the appendix—a vast ancient stomach, now an atrophic, dangerous and treacherous organ.

Course.—The jejunal artery courses distalward, ventralward and leftward practically parallel to the aorta. Its course is dorsal to the pancreas and splenic vein, while it is ventral to the transverse duodenum and left renal vein. It

produces a depression on the dorsal surface of the pancreas. It makes a depression on the ventral surface of the duodenum. It passes dorsal to the stomach and transverse colon It courses in the depression of the duodenojejunal angle. It passes distalward between the blades of the mesenteron at its radix mesenteri, or root, ending at the proximal end of the "ileocolic circle," a distance of some three inches. Throughout its entire course the jejunal artery is embedded in a powerful sheath of connective tissue of ample lumen to allow peristalsis during its remarkable changing volume. It emerges between the corpus pancreaticus and pars horizontalis duodeni distal. It crosses the duodenum at right angles, being directly applied to its surface. It possesses a spiral course, hence branches may arise from any quarter of its circumference (for example, duodenal, jejunal, ileocolic, right colic, colica transversa). The course of the jejunal artery is first ventralward, second distalward and third rightward. It possesses a left convexity and a right convexity (at least when injected and allowed to become fixed with the subject on the dorsum).

Dimension.—The average dimensions of the jejunal artery are: (a) length, two to three inches (b) diameter, one-third of an inch. It is the maximum branch of the abdominal aorta. It diminishes in diameter from origin to termination.

Relations.—The relations of the jejunal artery are: dorsally with the aorta, vena cava, left renal vein, duodenum, arteria ovarica (spermatica); ventrally with the pancreas, splenic vein, transverse mesocolon, enteron; rightward the jejunal artery is in relation with the proximal mesenteric vein (trunk); leftward it is related with the proximal jejunum. The relations of the jejunal artery to the abdominal brain (plexus celiacus) in intimate and profound. In fact, the dense fibrous sheath surrounding the jejunal artery is powerfully interwoven with that of the celiac axis. The nervus vasomotorius is solidly and compactly anastomosed with the sheath of the jejunal artery and that of the celiac axis. The most difficult dissection to free the jejunal artery and celiac axis is that of removing the abdominal brain and its radiating nerve cords. A significant clinical factor is that the jejunal artery courses between pancreas ventrally and duodenum dorsally. The anatomic arrangement in the course of the jejunal artery, being ventral to the duodenum, becomes of significant importance in splanchnoptosia, as during the progress of this disease the jejunal artery compresses the duodenum firmer and firmer, ending in gastroduodenal dilatation. In general the jejunal artery divides into or birfurcates into two branches, namely: (a) the main branch, which supplies the ileum, the ileal artery (the jejunum and duodenum are supplied by branches from the jejunal artery: (b) the arteria ileocolica, which is the second arm of the jejunal artery bifurcation emerging in the region of the root of the distal arteria mesenterica proximal and immediately distal to the transverse duodeium. Located between the bifurcated arms (ileocolic and ileal) of the jejunal artery and their distalward anastomoses is the "ileocolic circle," a constant structure with constant location, and a significant vascular landmark, as generally the appendicular artery arises from it. In other words, the "ileocolic circle" lies in the major bifurcation of the jeunal artery and practically originates the arteria appendicularis. The distal end of the ileal artery anastomoses with the distal end of the ilecolic artery, completing the "ileocolic circle," hence from the right border (ilecolic artery) of the ileocolic circle emerges the appendicular artery, and from the left border (ileal artery) emerges the rami ilei.

II. Branches of the Proximal Mesenteric Artery.

The branches of the proximal mesenteric artery supplying the enteronic and colonic territories should be classed in two divisions, namely: those of the enteron; and those of the colon, as follows:

(A) Branches of the *enteron*:
1—Arteria pancreatica mesenterica proximal (inconstant branches from the proximal mesenteric artery to the pancreas).
2—Arteria pancreaticoduodenalic distal.
3—Rami jejunales.
4—Rami ilei.

(B) Branches of the *colon*:
1—Arteria ileocolica.
2—Arteria colica dextra.
3—Arteria colica transversa.
4—Arteria colica transversa accessoria—(Waldeyer's artery).
Rami jejunales.
Rami ilei.

ARTERIES OF THE ENTERON.

Synonyms.—Vas intestini tenuis, arteriæ intestina tenuis, arteriæ intestinales, arteriæ duodenalis et arteriæ jejunales et arteriæ ilei, arteries of the enteron, rami intestinales. An exact and definite expression would be rami jejunales and rami ilei. As a convenient and appropriate expression we will employ the term *arteries of the enteron* (duodenum, jejunum, ileum). The arteries of the enteron will include those supplying the duodenum (rami duodeni), jejunum (rami jejunales), ileum (rami ilei). The average score of arteries supplying the enteron (small intestines) have received no particular name except as to enteronic segments—doudenum, jejunum and ileum. The enteronic arteries posses so much in common that they should be practically described as a unit. The arteries of enteron consist of large, parallel, branches directed distally and obliquely leftward between the blades of the mensenteron. The arteries of the enteron, consisting of three segments—trunk, arch, straight terminal vessel, supply the whole of the enteron except the proximal duodenum (which is supplied by the arteria pancreaticoduodenalis priximal, a branch of the arteria gastroepiploica). The enteronic arteries supply the territory of the enteron (small intestine), a tube of more than an inch in diameter and an average of twenty-one feet in length. For convenience of description and detailed comprehension I shall divide the mensenteron into three vascular zones, namely:

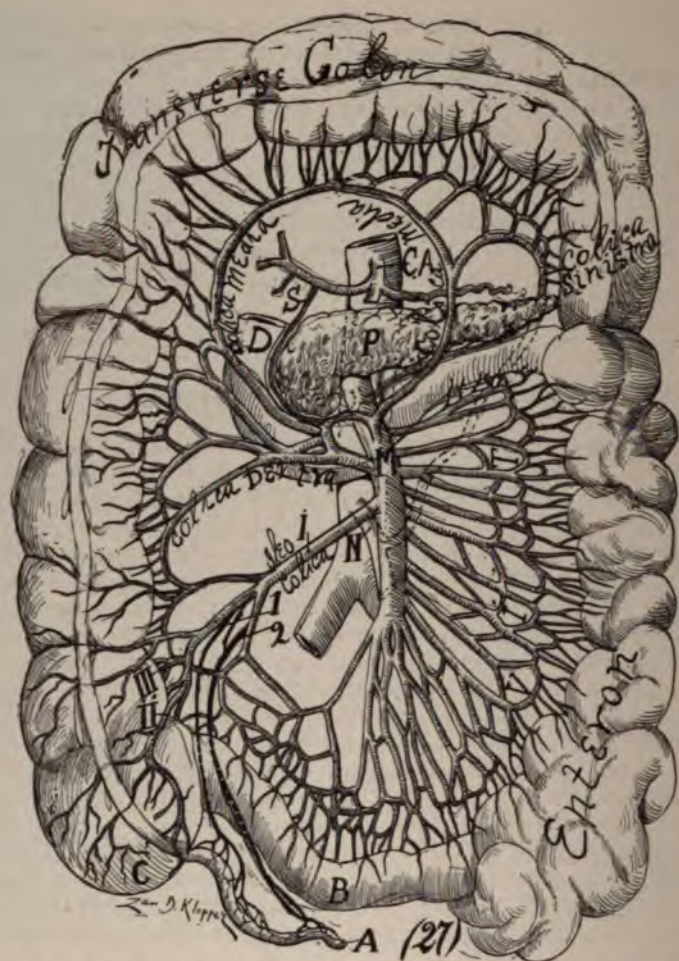
(1) The zone of the mesenteronic trunk—three inches.
(2) The zone of the mesenteronic arch—two inches.
(3) The zone of the mesenteronic "straight terminal vessel"—one inch.

We thus have the trunk, arch and "straight terminal vessel" zones of the enteron. The most important zone is that of the "straight terminal vessel." on account of its application to surgical procedures.

I. Trunk of the Enteronic Arteries.
Rami jejunales.
Rami ilei.

Under the subject of trunk of the enteronic artery we will include the segment of the enteronic artery extending from its root or the trunk of the proximal mesenteric artery to the first mesenteric arch. The primary or first mesenteronic arch is supported by two trunks, arteries, pillars, of large dimension. It is the maximum mesenteronic arch, composed of the maximum segment of the enteronic artery—the trunk ranging from one-half to five inches in length. I shall term the pillars of the primary mesenteronic arch the trunk of the enteronic artery.

II. Origin of the Enteronic Arteries.
Rami jejunales.
Rami ilei.



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "ENTERO-COLIC CIRCLE." MAJOR MESOCOLIC CIRCLES." "STRAIGHT VESSELS."

Fig. 27. Ventral view. Appendicular artery is duplicate, emits 16 branches to appendix. Ileocolic arches 7. "Straight vessel" in colon and enteron of ample length for clamp or ligation.

Observe accumulations of arteries and arches in region of right colic artery. For more complete description see section II., page 13.

The enteron consists of the duodenum, jejunum and ileum; the mesenteron is its mesentery. The enteronic arteries arise proximally from the right circumference of the proximal mesenteric artery (arteria pancreaticduodenalis distal), and also from its dorsal circumference. The rami jejunales and rami ilei rise from the left convex circumference of the proximal mesenteric artery and pass obliquely leftward and distalward to supply the enteron. The enteronic arteries arise in a series, however, in unequal distances of asunder (see figures 42, 43, 44, 51, 52). The unequal distance of separation is noticeable in the proximal half of it. Proximal mesenteronic artery or jejunal artery, however; particularly irregularity is observable in many subjects at the point where the jejunal artery bifurcates into the ileocolic and ileal branches to form the ileocolic circle. In figures 22, 24, 27, 46, 30, 45, the branches originate at uni-

form distances from each other. In general the distances between the origin of the rami jejunales and rami ilei is greater in the ileum than in the jejunum. Marked separation of origins in the rami jejunales may be observed in figures 34, 42, 43, 44. Marked separation of the rami ilei may be observed in figures 24, 26, 27, 46. I shall discard the origin of vessels from concavity and convexity of the proximal mesenteric artery, as it is of doubtful practicability, and also the curve is perchance an artificial production through injection and force of gravity.

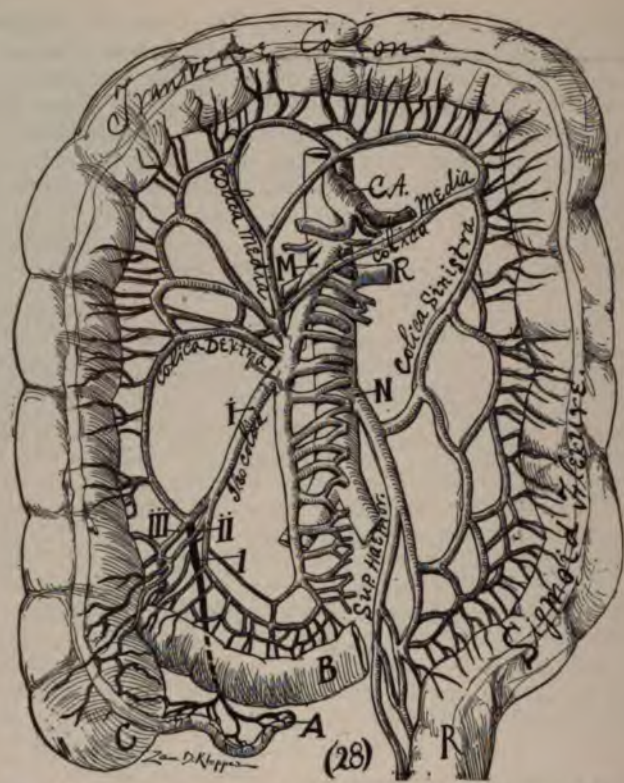
III. Number of Enteronic Arteries. { **Rami jejunales.** / **Rami ilei.**

In thirty-four subjects the average number is twenty-one. The maximum number is twenty-eight. The minimum number is fifteen. The enteronic arteries were numbered from the proximal ramus jejunalis to the distal ramus ileum or to the arteria ileocecalis (dorsal and ventral). The number of enteronic arteries is not constant, but very variable. They manifestly depend on the length of the enteron, which varies three times its minimum length, ten and one-half feet There appears to be one enteronic artery for each foot of enteron. I measured the enteron in six hundred subjects, and found its minimum length ten and one-half feet, its maximum length thirty-two feet, and its average length twenty-one feet. Hence, it is probable the number of enteronic arteries vary with the number of feet in the enteron. Their number varies thirteen (that is, from fifteen to twenty-eight), almost double, which is more than half their average number, that is, twenty-one. The trunk of the arteries of the enteron may present duplicity see figures 41, 44, 45, 57). The mesenteronic arches may present duplicity (figure 58).

IV. Dimensions of Enteronic Arteries. { **Rami jejunales.** / **Rami ilei.**

The proximal half dozen jejunal branches are larger than raidial. The enteronic arteries are unequal in dimension. They decrease in diameter and length from the proximal jejunal to the distal ileal branches. The jejunal branches (rami jejunales) will average three inches in length and one-eighth inch in diameter. The ileal branches (rami ilei) may become similar in dimensions to a knitting needle or a wheat straw and a half inch in length. The rami jejunales, that is, the proximal third of the enteron, possess greater length than those of the rami ilei, that is, the distal two-thirds of the enteron. The rami jejunales (with the exception of the first or most proximal one) are larger than the rami ilei. After a length of from one-half inch to three inches they bifurcate to produce the formation of mesenteronic arches. The length of the arteries of the enteron (trunk, arch and "straight terminal vessel") is greatest in the middle of the mesenteron. The proximal enteronic arteries are usually the longer. The last half of the enteronic arteries (rami ilei), some twelve in number, are limited in dimension (length and diameter).

Among the arteries of the enteron there are branches of two dimensions—a major and a minor (see figures 30, 44, 66, 47). The minor enteronic artery occurs chiefly among the rami jejunales. It may be merely a bar dividing an arch in the first series. However, it presents neither constancy of dimensions nor location. The segment of the "straight terminal vessel" supplying the dorsal wall of the enteron is of greater dimension than that supplying the ventral wall, except the artery supplying the appendicus epiploicus. The dimensions of the three segments of enteric arteries are: (a) trunk—equals three-sixths of the mesenteron or three inches; (b) arches—equal two-sixths of mesenteron or two inches; (c) straight terminal vessel—equal to one-sixth of the



ARTERIA APPENDICULAR. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL." "ENTERO-COLIC CIRCLE." "MAJOR MESOCOLIC CIRCLE."

Fig. 28. Ventral view. For complete description see section II, page ——.

mensenteron or one inch. Hence, the mesenteronic trunk represents three, the arches two, the straight terminal vessel one inch of the mesenteron.

V. Course of Enteronic Arteries. { Rami jejunales. Rami ilei.

The enteronic trunks course from the proximal mesenteric artery mainly parallel to each other between the blades of the mesenteron to the concave border of the enteron. They are solidly fixed in sheaths of strong connective tissue (the membrana mesenterii propria), possessing ample lumen to allow marked peristalsis—volume changes. The direction of the enteronic branches is distalward and leftward. The jejunal trunk courses horizontalward. The ileal trunk courses distalward. The course of the three segments of the enteronic arteries, namely: trunk, arches, and "straight terminal vessel," is in a similar direction ventralward, leftward and distalward. The course of the enteronic arteries is spiral, beginning at their origin proximally on the right circumference of the proximal mesenteric artery (arteria pancreaticoduodenalis distal) and gradually arising from the dorsal, left and finally from the ventral circumference of the proximal mesenteric artery the arteriæ colicæ arise from its right and ventral surface). Each enteronic trunk, after a shorter or a longer distance, bifurcates in its course to enter the formation

of the mesenteronic arches which occupy the ventral or peripheral half of the mesenteron. The convexity or peripheral mesenteronic arches emit the "straight terminal vessel," which occupies one-half to two inches of the peripheral mesenteron. Hence the course of the enteronic arteries through the mesenteron, the trunks occupy one-half, the arches one-third, and the straight terminal vessel one-sixth of the distance from the jejunal artery and ileal artery to the enteron. The location of the bifurcation in the course of the enteronic trunk is variable—one-fourth to three inches from the jejunal artery or ileal artery. In figure 47 both extremes of early and late bifurcations are noted, as well as figure 66, where three inches difference in length of the trunk may be observed.

Dimensions of Trunk.—The length and diameter of the enteronic trunk lessens from proximal ramus jejunalis to distal ramus ileus. For example, figure 44 is a typical illustration. Irregular location of the trunk bifurcation (and hence variation in length of trunk) is noted in figure 44. Early bifurcation may be observed in figure 36. Late bifurcation may be learned in figures 33, 34. Peculiar location of bifurcation may be noted in figure 27.

VI. Characteristics of the Three Segmental Enteronic Arteries.

The three segments of the enteron—duodenum, jejunum and ileum—possess arteries of characteristic origin, location, dimension, number and relation.

(A) *Characteristics of the Duodenal Arteries.*

Arteriae Duodeni.—The duodenum is practically supplied by two arteries—arteria pancreaticoduodenalis distal (the proximal enteronic artery) and pancreaticoduodenalis proximal (a branch from the arteria gastroepiploica). The duodenal arteries constitute the arcus duodenalis, duodenal arc or duodenal circle. They supply a foot of the enteron, the most important segment of the small intestine—the duodenum. The distal and proximal duodenal arteries course between the caput pancreaticus and the convex border of the proximal mesenteric artery or from the first or second jejunal branches (rami jejunales). The pancreatic in the duodenal cavity, richly supplying both organs. The proximal arteria pancreaticoduodenalis arises from the arteria gastroepiploica dextra. (Figures 51, 57, 46, 59). The duodenum is supplied by arteries from two sources. The distal arteria pancreaticoduodenalis arises from the right circumference of the jejunal artery. It may arise from the right, dorsal or left circumference of the jejunal artery or from the first or second jejunal branch (ramus jejunalis). The Pancreatico-duodenal artery courses between the duodenum and caput pancreaticus in the duodenal concavity, richly supplying both organs. The proximal arteria pancreaticoduodenalis arises from the arteria gastroepiploica (dextra) and *courses* in a reverse direction from the distal duodenal, solidly, compactly anastomoses with it—like a stovepipe showing no mark of inosculation. The proximal and distal arteria pancreaticoduodanalis solidly inosculates frequently double, while collateral loops course between the caput pancreaticus and duodenum, abundantly supplying both adjacent organs. There is frequently a dorsal and ventral duodenal artery with different origins (contributing the "circle of the pancreatico duodenal artery") and numerous anastomotic arches which richly and compactly anastomose the branches of the celiac axis to the branches of the jejunal artery. The arteria hepatica is the main medium of anastomosis with the proximal mesenteric artery (see figure 56).

Origin.—The origin of the arteria duodeni is proximally from the hepatica, gastroepiploica dextra, splenica; distally from the proximal mesentric (right, dorsal, ventral and left surface or from its branches.)

Location.—The location of the arteria duodeni is between the caput pancreaticus and the duodenum. The proximal and distal ends lie between the

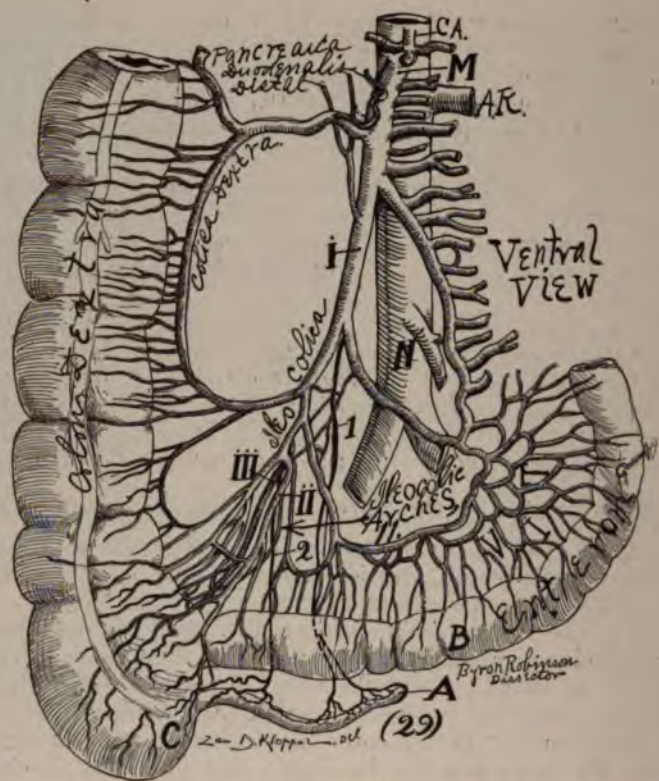


FIG. 29.—APPENDICULAR ARTERY, "ILEO-COLIC CIRCLE," "ILEO-COLIC ARCHES." "VAS INTESTINI TERMINALE RECTUM." RIGHT DISTAL "MAJOR MESOCOLIC CIRCLE."

Ventral view. 1, arteria, appendicularis (primary vessel), a vessel of limited dimension, arises from the right circumference of the ileo-colic circle, i. e., from the ileo-colic artery, and supplies the free portion of the appendix. 2, arteria appendicularis (secondary vessel) a vessel of limited dimension arises from the arteria ileo-cecalis dorsalis and supplies the base of the appendix. The two appendicular arteries anastomose as an arch, resembling mesenteric arches.

The ileo-colic circle is divided by peculiar cross-bar arteries. It is formed by the bifurcation of the jejunal artery into the ileal and ileo-colic arteries and completed by their distal union. The significance of the ileo-colic circle is in that it originates the main appendicular artery and is an inosculation circle. It is a constant structure in a constant location.

The ileo-colic arches, eleven in number, are of maximum dimension and calibre, and originate an appendicular vessel (secondary).

The right distal "major mesocolic circle" is evident. The "ileocolic arches" number 11. See section II., page 13.

gastroepiploica dextra and jejunal artery The distal pancreaticoduodenalis is located dorsal to the jejunal artery. The proximal pancreaticoduodenalis is located dorsal to the duodenum and caput pancreaticus.

Dimensions.—The dimensions in length and diameter dorsal to the duodenum resemble those of the distal ileum. They may resemble a wheat straw. The length may be from three to six inches.

Number.—The number of duodenal arteries is generally two—a dorsal and a ventral. The dorsal and ventral arteria duodeni may be practically separate arteries, with different origins or partly different origins, or be produced by bifurcations and anastomotic loops.

Relations.—The arteria duodeni relates itself foremost with the caput pancreaticus and duodenum, and secondary with the extensive anastomotic apparatus between the celiac axis and the jejunal artery located chiefly within the pancreas. The anastomotic vascular apparatus connecting the celiac axis and jejunal artery we will term the arcus gastricus intestinalis, and it is composed of the arcus duodenalis plus the arcus pancreaticus.

(B) *Characteristics of the Jejunal Branches (Rami Jejunales.)*

The arteries of the jejunum supply about eight feet of enteron, an artery for each foot—the segment of the enteron of maximum structure and function. The rami are about the dimension of the carotid or radial. The trunk may be some three inches in length and one-eight inch in diameter. The rami jejunales are the largest and longest of the enteronic arteries. They originate intimately adjacent and course obliquely leftward and horizontalward. They may vary in number and regularity (see figures 43, 44). One of the largest jejunal trunks is frequently located in the region opposite the origin of the arteria ileocolica. This is the ileal branch, marking the bifurcation of the jejunal artery or proximal mesenteric artery. The half dozen arteries of the jejunum are the maximum arteries of the enteron and emerge proximal to the emergence arteria ileocolica. The jejunal branches course mainly horizontalward. Practically the jejunal artery bifurcates at the point of emergence of the arteria ileocolica. The rami jejunales—maximum enteronic branches—are located proximal to the ileocolica. The rami jejunales possess maximum trunks and primary arches (length, diameter), hence, the characteristic of the secondary arches of the rami ilei which tend more to resemble a woven network. Many of the secondary arches of the jejunal branches resemble exactly the secondary arches of the Riolan-Haller arch, or arcus transversus colicus, that is, the base of the secondary arch is composed of or rests on the convexity of the primary arch. Occasionally a proximal jejunal arch will support on its convexity a series of minor or secondary arches exactly similar to that of the arcus transversus colicus (see figures 51, 52, 57). There is a tendency of one or more of the rami jejunales to bifurcate adjacent to its origin. This distorts and produces irregularity of space between the rami jejunales (see figures 25, 27, 30, 33, 36, 40, 42, 43, 45, 47, 56).

Irregularity of space is also caused by duplicity of the trunk of the rami jejunales (see figures 41 44, 66). Irregularity of space between the rami jejunales is caused by the association of a major and a minor trunk (see figures 30, 33, 43, 46, 47, 51, 56).

The *course* of the rami jejunales is more horizontal than that of the arteria ilei.

The *origins* of the rami jejunales are relatively more adjacent than those of the rami ilei.

The *number* of rami jejunales is relatively greater than that of the rami ilei.

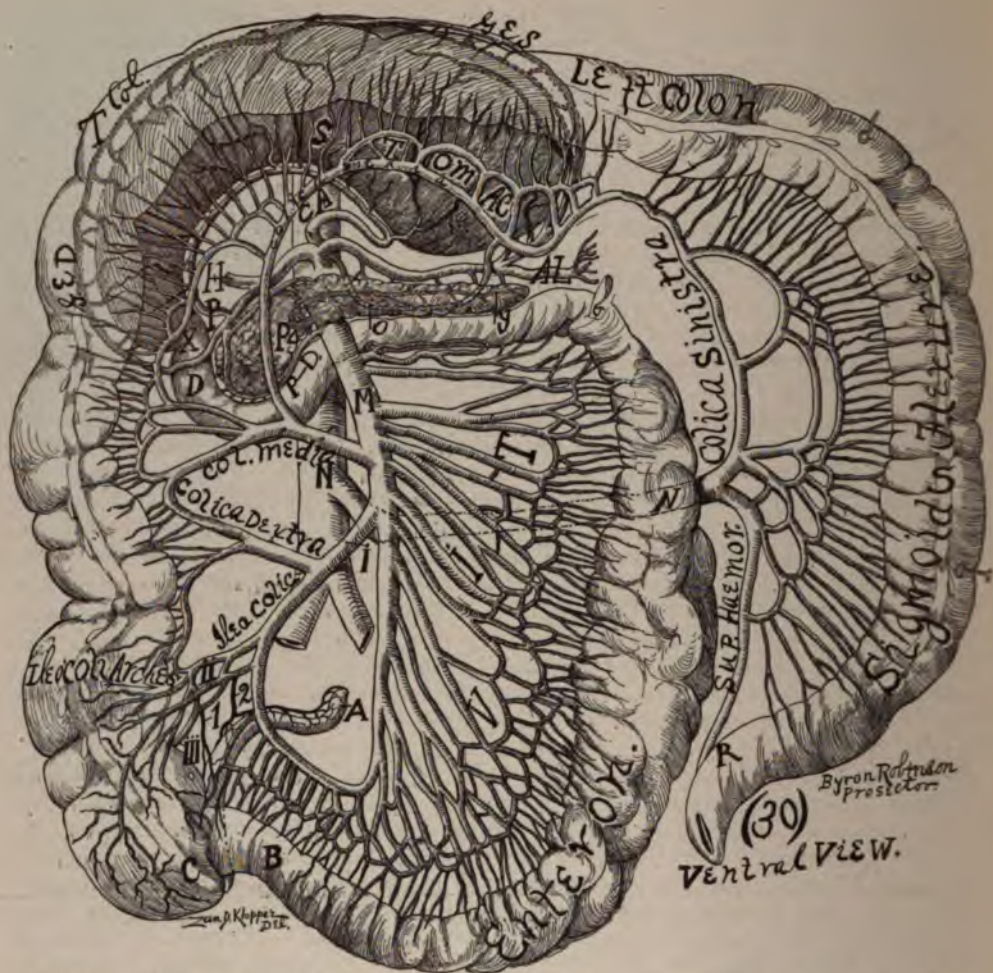
The *dimension* (length and diameter) of the rami jejunales is absolutely greater than that of the rami ilei.

The *location* of the rami jejunales is more proximalward and lateral than that of the rami ilei.

The *relations* of the rami jejunalis is with the organ of the proximal abdomen.

(C) *Division of Jejunal and Ileal Branches.*

In many subjects there is a marked distinction between the jejunal and ileal branches, not only by the bifurcation of the artery into ileocolic and ileal arms and difference in direction, but there is a disturbance, a complexity, a whorl of arches located at the junction of the jejunal and ileal arches (see figures 30, 34, 33, 36, 43, 44, 46, 47, 51, 52, 56, 57, 25, 39, 42).



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE. "STRAIGHT TERMINAL VESSEL." ILEOCOLIC ARCHES." ILEAL ARTERY," "CONCENTRIC GASTRIC CIRCLES." ENTERO COLIC CIRCLE." (RIOLAN-HALLER ARCH). AREAE ARTERIACAE. "JEJUNAL ARTERY."

Fig. 30. Specimen injected, distended, dried and employed as a model by the artist, Dr. Zan D. Klopper. Ventral view. A, appendix. B, ileum. G, cecum. M, proximal mesenteric artery. I, arteria ileocolica. II, arteria ileocecalis dorsalis. III, arteria ileocecalis ventralis. N, distal mesenteric artery. Vit, vas intestini tenuis.

1, arteria appendicularis (primary vessel), a vessel of limited dimension orises from the arteria ileocoecalis ventralis adjacent to the right border of the "ileocolic circle" and supplies the free end of the appendix. 2, arteria appendicularis (secondary vessel) a vessel of limited dimension arises from the arteria ileocoecalis dorsalis (i. e. from the "ileocolic arches") and supplies the base of the appendix. The two appendicular arteries emit 14 branches to the appendix.

The appendicular artery—a minimum artery is significant as it nourishes the dangerous and treacherous atrophic appendix—dangerous because perityphlitis kills and treacherous because its capricious course cannot be prognosed. The atrophying appendix is supplied by arteries of limited number and caliber.

The general aetiology of perityphlitis is trauma of the psoas muscle producing perityphlitic peritoneal adhesions which by contraction compromise the appendicular vessel (especially in meso appendix) and flex the appendix, checking drainage, ending in perforation.

The "ileocolic circle" is formed by the bifurcation of the jejunal artery into the ileocolic

and ileal arteries and completed by their distal anastomosis. The ileocolic circle is located in the ileocolic angle and is a constant structure.

The ileocolic circle is a typical anostomotic ring, an "inosculation circle" possessing peripheral automatic specialized ganglia and a peripheral viscus.

Stimulation of the automatic peripheral ganglia dilates its vessels and engorges it. Peripheral viscus (or viscera). The object of an "inosculation circle" is to hyperaeminize its peripheral viscus and to transport blood volume from one viscus to another. It is the line of least resistence in circulation.

The "ileocolic arches" 3, and are formed by the combined anastomosis of the arteria ileocoecalis dorsalis et ventralis. The "ileocolic arches" are a primordial vascular landmark of the cecum (and fading appendix). They resemble these of the mesosigmoid or other arches located in flexures of the tractus intestinalis. They are located in the ileocolic angle. They average five for each individual. The clinical signification of the ileocolic arches is included in their relation to surgical procedures on the colon and appendix. They may be clamped or ligated without molesting the "ileocolic circle."

"Vas intestini terminale rectum" or "straight terminal vessel" of the intestine extending rrom the mesenteronic or meso-colic arch to the border of the enteron or colon, is of ample length (½ to 2 inches) to be clamped or ligated without molesting the mesenteronic or meso-colic arch and thus avoiding to the intestine the jeopardy of ulceration or gangrene.

The straight terminal vessel is of practical importance in intestinal surgery. In the mesenteron there are perhaps six straight terminal vessels" to the inch. In the meoscolon there are perhaps four straight terminal vessels" to the inch.

The "ileal artery" extends from the bifurcation of the jejunal artery to its distal anastomosis with its opposite fellow, the ileocolic artery. The ileal artery forms the left circumference and the ileocolic artery forms the right circumference of the "ileocolic circle." The ileal artery emits branches to the ileum of such a limited caliber with consequent limited blood volume especially at the distal ileum that it is subject to ulceration or perforation (in typhoid fever and tuberculosis). Blood is the prophylactic against disease.

"Concentric gastric circles." There is a proximal and distal gastric circle.

The proximal gastric circle, the lesser of the two concentric gastric circles, is formed by the anastomosis of the gastric and hepatic artery, and the circle is completed by the arteria hepatica communis. The circle is located along the lesser gastric curvature. The proximal gastric circle may measure 10 inches in circumference.

The distal gastric circle, the greater of the two "concentric gastric circles", lying along the greater gastric curvature is formed by the anastomosis of the gastro-epiploica (sinistra and dextra) and completed by the hepatic and splenic arteries. The distal gastric circle may measure 20 inches in circumference.

The gastrium practically lies between the two "concentric gastric circles" and in gastrectomy a ligature is required at the right and left end of the gastric and gastro-epiploic arteries.

Enterocolic circle or arcus transversus colicus is formed by the inosculation of the arteria transversa colica (or arteria transversa colica accessoria—Waldeyer's artery) and the arteria colica sinistra of the distl mesenteric artery. The Riolan-Haller arch may measure 18 inches in circumference. The Riolan-Haller arch is frequently interrupted by an accessory transverse colic artery or what I have termed Waldeyer's artery. It is of extreme practical significance in surgical procedures on the intestines that the Riolan-Haller arch be not ligated or interrupted as it may jeopardize the colon to ulceration or gangrene. The Riolan-Haller arch may possess on its periphery or be imposed on its circumference by a series of minor arches.

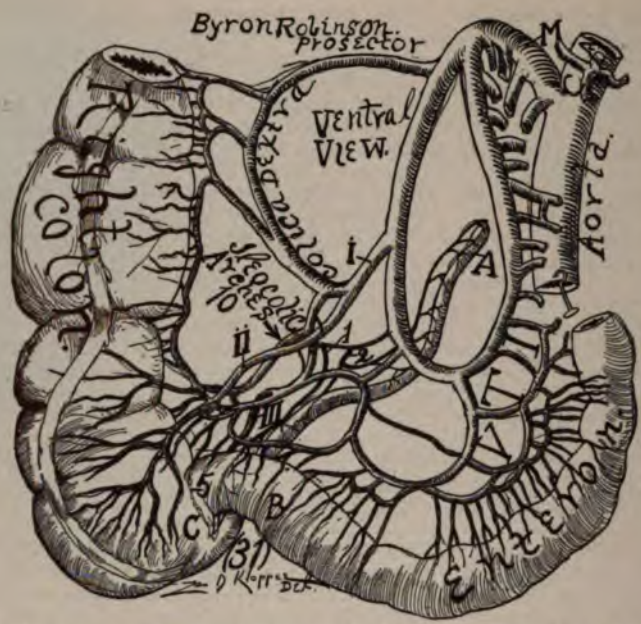
Areae arteriacae artery or arterial fields produced by the arches and circles of the proximal and distal mesenteric artery are located mainly on the dorsal wall. The arterial fields circumscribe or bound viscera bilaterally and may be designed as proximal and distal bilateral dorsal arterial fields.

Jejunal artery extends from the ventral surface of the aorta dorsal to the pancreas to the bifurcation to form the "ileocolic circle."

The rami jejunales course horizontalward, the rami ilei course distalward. The difference is evident and distinct. It presents some primordial condition of nourishment or differentiation. The original stamp of division between the jejunal and ileal branches is also presented by a distinct, marked space between the distal trunk of the jejunal artery and the proximal trunk of the ileal artery.

(D) *Characteristics of the Rami Ilei.*

The arteries of the ileum supply the distal half of the enteron—some dozen feet—with a dozen arteries, an atery for a foot. The mesenteronic trunk, branch, arch and "straight terminal vessel" are less in dimension (length and



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL." "ILEAL ARTERY." JEJUNAL ARTERY.

Fig. 31. Ventral view. Specimen injected, distended, dried and employed as a model by the artist, Zan D. Klopper. A, appendix. B, ileum. C, cecum. M, proximal mesenteric artery. I, arteria ileocolics. II, arteria ileocecalis dorsalis. III, arteria ileocecalis ventralis. N, distal mesenteric artery.

Arteria appendicularis (primary and secondary vessel) two vessels of limited dimension arises from the ileocolic arches, i. e., the arteria ileocoecalis dorsalis et ventralis. Practically one might consider number 2 (the primary vessel) as arising from the right border of the ileocolic circle and supplying the main (free) portion of the appendix. The two appendicular arteries emit 10 branches to the appendix.

The "ileocolic circle" a typical "inosculation circle" is significant for its maximum circumference and maximum caliber of its arteries. See section II., page 13.

diameter) than those of the jejunum. The rami ilei are located practically distal to the point of arteria ileocolica emergence, that is, distal to the bifurcation of the jejunal artery. I shall designate the emergence of the ileocolic artery or the bifurcation of jejunal artery as the mark of division of the enteron into jejunum and ileum. It is practically the point of bifurcation of the ileocolic and ileal artery, which end on the ileocolic circle. Distal to the ileocolic emergence the enteronic arteries assume different characteristics—limited trunks, multiple arches, distalward direction. Irregularity appears among the arches and trunks (see figures 25, 27, 33, 36, 39, 40, 41, 42, 43, 46, 47, 56).

The *course* of the rami ilei is more distalward and less parallel than that of the rami jejunales.

The *origins* of the rami ilei are relatively more distant asunder than those of the rami jejunales.

The *number* of rami ilei is relatively less than those of the rami jejunales, however, absolutely greater from supplying a greater length of enteron.

The *dimension* (length and diameter) of the rami ilei is absolutely less than that of the rami jejunales.

The *location* of the rami ilei is more distalward and medianward than that of the rami jejunales.

The *relation* of the rami ilei is with the organs of the distal abdomen. The limited volume of blood conducted by the rami ilei enables the ileum to digest a more limited quantity of food than the jejunum and consequently jeopardizes the ileum to more diseases than the jejunum—typhoid fever, tuberculosis, ulceration; for it is blood that cures and prevents disease.

III. Mesenteronic Arches.

The zone of the mesenteronic arches constitute one-third of the width of the mesenteron. Every mesenteronic arterial trunk extending from the jejunal artery and from the ileal artery bifurcates or divides, after a longer or shorter course, into two diverging branches which inosculate with the next adjacent or collateral branches forming the primary series of mesenteronic arches. The primary series of mesenteronic arches form what I call the primary zone of mesenteronic arches. It is the zone of mesenteronic arches possessing maximum meshwork, areolæ, the maximum width and minimum curve. Twenty subjects averaged twenty-two arches in the primary mesenteronic zone. The nature, location, dimension (length and diameter), form, pecularity and variation of the arches produced by two trunks of the mesenteronic artery may be noted in numerous illustrations (particularly in figures 34, 66, 43, 47, 56.) This primary zone is the mesenteronic zone of the trunk of the enteronic arches. The trunk of the enteronic arteries will be considered as to origin, location, number, dimension, course. The trunk of the enteronic arteries form the pillars or supports of the primary mesenteronic zone of arches.

From the convexity of the primary series of mesenteronic arches directed toward the enteron several branches arise which early bifurcate and anastomose, forming a secondary series of mesenteronic arches which describe a longer but narrower curved zone in the mesenteron than the previous (primary) series. I shall call this the secondary zone of the mesenteronic arches. Twenty subjects averaged thirty-two arches in the secondary mesenteronic zone.

From the convexity of the second series of mesenteronic arches many branches arise which shortly bifurcate and anastomose, forming a tertiary series of mesenteric arteries which describe a curved zone of mesenteric arches of greater length but less width than the previous (secondary or more median located) zone of mesenteronic arches. This is the tertiary zone of mesenteronic arches. It is the usual number of what I shall term major mesenteric arches (internal, medial). Twenty subjects averaged eighteen arches in the tertiary mesenteronic zone.

There may, however, be frequently a quartenary zone, occasionally a quinary zone, and rarely a sexternary zone of mesenteronic arches. I shall term these the three minor zones (external, lateral) of mesenteronic arches.

From the convexity of the tertiary series of mesenteronic arches numerous branches arise which rapidly bifurcate and anastomose, forming a quartenary series of mesenteric arches which describe a curved zone of mesenteronic arches arches of greater length but of less width than the previous (tertiary) zone of mesenteronic arches. Twenty subjects averaged five arches in the quartenary zone.

From the convexity of the quartenary series of mesenteric arches multiple branches arise which immediately bifurcated and anatomose, forming a quinary series of mesenteric arches which describe a curved zone of mesenteronic arches of greater length but of less width than the previous (tertiary) zone of mesenteronic arches. Twenty subjects averaged one and three-eighths arches in the quinary zone.

From the convexity of the quinary series of mesenteronic arches a multitude

APPENDICULAR ARTERY. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL." "MAJOR MESOCOLIC CIRCLE." "ENTERO-COLIC CIRCLE."

Fig. 32. Ventral view. Arteria appendicularis, a single vessel of limited dimension, arises from the right border of the ileo-colic circle, i.e., from the ileo-colic artery. The appendicular artery emits eleven branches to the appendix. The ileo-colic circle formed by the bifurcation of the jejunal artery into the ileal and ileo-colic arteries and completed by their distal union.

Its significance is apparent in being the origin of the appendicular artery.

The ileo-colic arches, numbering four, are of maximum dimension and caliber.

Enterocolic circle. The Riolan-Haller arch, arcus transversus colicus, or entero-colic circle, is formed by the inosculation of the arteria transversa colica or arteria transversa colica accessoria—Waldeyer's) and the arteria colica sinistra of the distal mesenteric artery. The Riolan-Haller arch is frequently interrupted by an accessory transverse colic artery of what I have termed Waldeyer's artery. It is of extreme practical significance in surgical procedures on the intestines that the Riolan-Haller arch be not ligated or interrupted, as it may jeopardize the colon to ulceration or gangrene. The Riolan-Haller arch may possess on its periphery or be imposed on its circumference by a series of minor arches. There is no arteria transversa colica or Waldeyer's artery.

For more complete explanation see section II., page 13.

of branches arise which bifurcate and anastomose, forming a sexternary series of mesenteronic arches which describe a curved zone of mesenteronic arches of patches of greater length but of less width than the previous (quartenary) zone mesenteronic arches. In twenty subjects only two possessed sextenary arches (see figures 42, 46).

When a series of six mesenteneronic arches exist one generally counts from one to three only in the mesenteronic zone, and they are located in the middle

of the mesenteron. Figure 44 possesses a sexternary mesenteronic zone of arches.

The *mesenteronic zone of arches* occupy the middle segment of the mesenteron or a zone of two inches, and presents a zone of wide-meshed arterial network. Mark, the mesenteronic zone of arches is more adjacent to the enteron by twice than to the trunk of the proximal mesenteric artery. The usual number of prominent serial zones of major mesenteronic arches is three. Practically the jejunum begins with a zone of arches containing three series and ends at the distal ileum containing a series of two. In the middle of the enteron there is usually a zone of mesenteronic arches containing a series of four, sometimes a series of five, and rarely a series of six. The secondary series of arches r secondary mesenteronic zone contains the greatest number of arches; however, it is vastly less in diameter than that of the primary mesenteronic zone. In twenty subjects the average number of mesenteronic arches for each individual was seventy-five.

In one subject (figure 57) the mesenteronic arches presented duplicity in the major portions of the mesenteron.

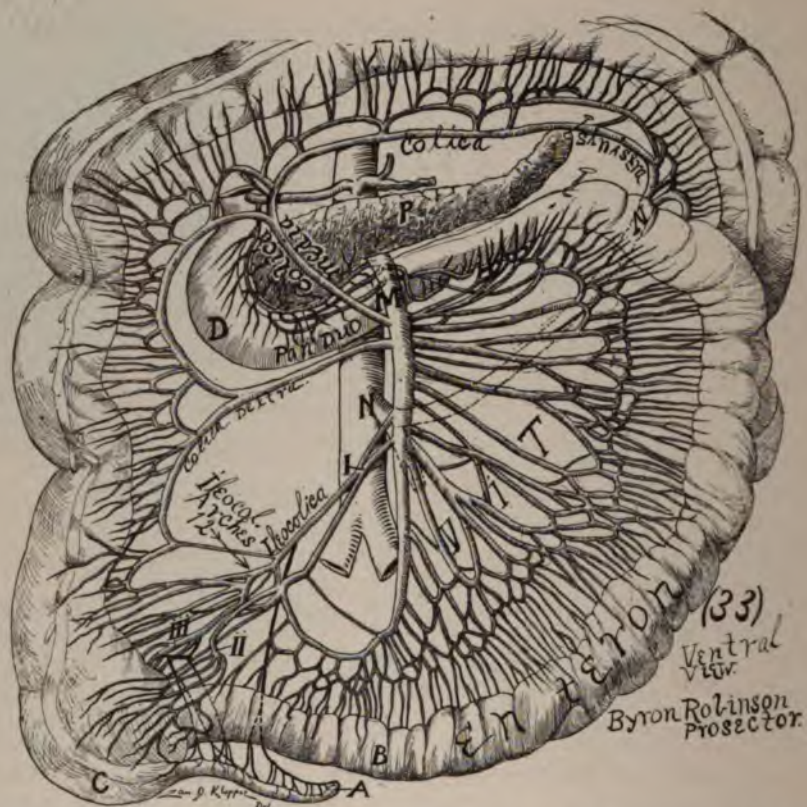
The *form* of the mesenteronic arches are mainly oval; however, multiple forms appear.

The *dimensions* of the mesenteronic arch in length vary from one-fourth to three inches—diameter, one-fourth to two inches.

The *location* of the maximum mesenteronic arches are in the primary mesenteric zone of the jejunum. The minimum mesenteronic arches are located in the mesenteronic zone of arches most adjacent to the enteron. The serial anastomotic mesenteronic arches, with maximum caliber of the arteries in the meshwork, not only regulate blood current, concentrate it at desired points, but also enables a limited number of branches located at the root of the mesenteron and occupying a limited space to supply branches to the entire enteron—twenty-one feet in length. Practically no intestinal branches arise from the concavity of the mesenteronic arches. The mesenteronic arches are traversed by delicate anastomosing twigs which supply: (a) membrana peritonei; (b) mesenterii membrana propia; (c) glandulæ mesenterii.

I.—Comparison of Mesenteronic and Mesocolic Arches.

The mesocolic arch is simpler but of greater dimension than the arch of the mesenteron. The concentric gastric arches (proximal and distal) possesses the maximum dimension of intestinal arches. The circumference of the transverse mesocolic arch is more irregular, serpentine, than that of the mensenteron. The number of mesocolic arches (averaged in twenty-two subjects, forty-five for each individual) are relatively much less than those of the mesenteron. The number of mesenteronic and mesocolic arches differ at different segments of colon and enteron. The mesenteronic arches are multiple and averaged seventy-three for each individual in twenty subjects. The mesocolic arches are multiple at four segments of the colon, namely: (a) at the cecum (ileocolic arches), averaging six for each individual; (b) at the flexura hepatica colica; (c) at the flexura lienalis colica; (d) at the flexura sigmoidea (averaging for each individual fifteen arches). In other words, the mesocolic arches are multiple at the colonic flexure. The mesocolic zone of arches includes from one to four series. The mesenteronic zone of arches includes from one to six series The mesocolic arches approach the colon more closely than the mesenteronic arches approach the enteron; however, both arches are located amply distant from the colon or enteron (one-half to two inches), that the "straight terminal vessel" of the intestine may be ligated or clamped without compromising the mesocolic or mesenteronic arches. The trunks of the gastric, colonic, and enteronic arteries are relatively similar in dimension. The mesenteronic zone of



APPENDICULAR ARTERY. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL." ILEAL ARTERY. ENTERO-COLIC CIRCLE. (RIOLAN-HALLER ARCH). MAJOR MESOCOLIC CIRCLE." (ARTERIAL FIELDS). JEJUNAL ARTERY.

Fig. 33. Specimen injected, distended and employed as a model by the artist, Zan D. Klopper. Ventral view. A, appendix. B, ileum. C, cecum. M, proximal mesenteric artery. I., Arteria ileocolica. II., Arteria ileocecalis dorsalis. III., Arteria ileocecalis ventralis. N, distal mesenteric artery. Vit, vas intestine tenuis.

1, arteria appendicularis (primary vessel) a vessel of limited dimension, arises from the right border of the "ileocolic circle," i. e., from the (duplicate) ileocolic artery and supplies the main (free) portion of the mesenteric artery.

2, arteria appendicularis (secondary vessels) vessels of limited dimension, arise from the arteria ileocecalis dorsalis and supply the basal portion of the appendix. The 3 appendicular arteries emit 17 branches to the appendix.

The right border of the ileocolic circle is practically duplicate.

The ileocolic arches numbering 12 are of varied dimension but of maximum caliber. The jejunal artery is significant on account of its compression of the duodenum during splanchnoptosia resulting in gastrio duodenal dilatation.

There is no arteria transversa accesoria or Waldeyer's artery.

The "ileocolic circle" a typical "inosculation circle" possesses automatic peripheral ganglia, a peripheral viscus and its function is to congest its peripheral viscus and transport blood volume from one viscus to another. For further detailed description see section II., page 13.

arches occupies a middle third of the menenteron, while the mesocolic zone of arches approach more adjacent to the colon.

The utility of the intestinal vascular arches is to regulate the quantitative flow of blood or to concentrate the required volume of blood in definitely localized intestinal segments during functionation—digestion. The proof of this

view is that the maximum number of arches (seventy-eight) and maximum volume of blood attends the enteron (especially the jejunum), the business portion or segment of maximum function—digestion; while the minimum number of arches (forty-five) and the minimum volume of blood attends the colon, the segment of minimum function –the fecal reservoir

We absorb drink from the enteron but secrete from the colon. Practically double the number of vascular arches belong to the enteron (seventy-eight) that belong to the colon (forty-five). In twenty-two subjects the number of mesocolic arches were, namely: minimum, 21—maximum, sixty-seven—average, forty-five. The mesocolic arches vary over three times their minimum number (twenty-one). In twenty-two subjects the number of mesenteronic arches were, namely; minimum, forty-seven—maximum, one hundred and fifteen—average, seventy-eight. The mesenteronic arches do not vary double their minimum number (forty-seven). This comparison indicates that the mesenteronic arches possess minimum variation, while the mesocolic arches possess maximum variation, which signifies that the mesenteronic arches are more important than the mesocolic arches. The minimum number of mesocolic arches (twenty-one) is more than double less than the minimum number of mesenteronic arches (forty-seven). Practically there are four "major mesocolic arches" (or circles) located bilaterally duplicate, one proximal to the other. This may be observed if the transverse colon be reflected proximalward (see figures 55, 58, 59) marked I. and II. (right), and III. and IV. (left). The four "major mesocolic arches" (or circles) are independent of the "ileocolic circle," a constant structure with a constant location. We will term these four "major mesocolic circles" the right and left proximal and distal. The four "major mesocolic circles" mark definite arterial fields on the dorsal peritonenum, which furnishes a form of topography for visceral location and boundaries.

Characteristic of Mesenteronic and Mesocolic Arterial Anastomosis.

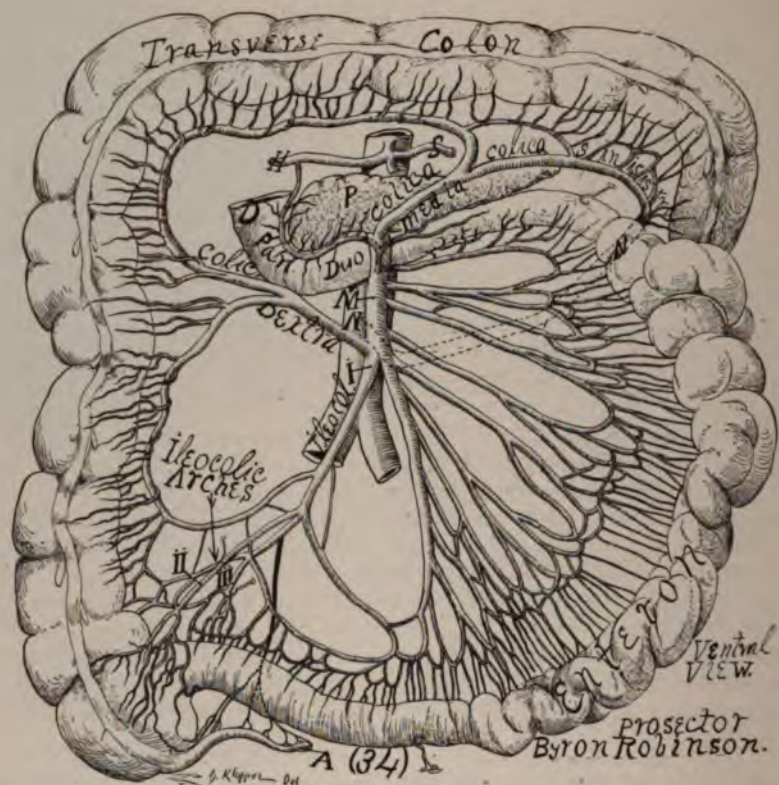
Inosculation, anastomosis (or vascular circles) is the crux, the basic utility of circulation, for the specialized automatic ganglia located on the periphery of the "inosculation circle" enables therapeusis to control the blood volume in them, for example, the "uteroovarian circle."

The chief characteristic of mesocolic and mesenteronic anastomosis is that the net or meshwork is composed of vessels of significant or maximum dimension. Intestinal arterial anastomosis is in direct contrast to joint arterial anastomosis, in which the mesh or network is composed of vessels of insignificant or minimum dimension. The form of intestinal arterial anastomosis allows maximum volume of blood to concentrate in required intestinal segments, for example, during digestion to intensify function in different locality (sensation, absorption, secretion, pendalsis). Also from local obstruction—(as an embolus)—this form of anastomosis allows maximum collateral circulation, blood from universal directions. Besides, if through position, pressure, or contents of any intestinal segment ample blood does not supply the segment from one direction, it can flow to it from multiple other directions.

III. "Straight Terminal Vessel" of Enteron.

Vas Intestini Terminale Rectum.

This is the mesenteronic zone of the "straight terminal vessel," constituting one-sixth of the width of the mesenteron, or a length of one inch. It is located on the mesenteronic border and in the concavity of the enteron. The "straight terminal vessel" is situated between the periphery of the minimum or most external mesenteronic arch and the concave border of the enteron. It averages an inch in length and constitutes in number some six arteries to the inch, lying closely adjacent and parallel like a corduroy road. The "straight terminal



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE." STRAIGHT TERMINAL VESSEL." "ILEOCOLIC ARCHES." "ILEAL ARTERY." "ENTERONIC CIRCLE." (RIOLAN-HALLER ARCH.) "JEJUNAL ARTERY." MAJOR MESOCOLIC CIRCLE.

Fig. 34. Specimen injected, distended, and employed as a model by the artist, Dr. Zan D. Klopper. Ventral view. A, appendix. B, ileum. C, cecum. M. primal mesenteric artery. I, arteria ileocolica. II, arteria ileocoecalis dorsalis. III, arteria ileocoecalis ventralis. N, distal mesenteric artery.

Arteria appendicularis, a vessel of limited dimension arises from the right circumference of the "ileocolic circle," i.e., from the ileocolic artery and supplies the appendix. The jejunal artery is important from its relation to splanchnoptosia and consequent gastro-duodenal dilatation.

The "ileocolic circle" is divided by peculiar crossbar arteries.

The "ileocolic arches" numbering 12 are of maximum dimension and caliber.

There is no arteria transversa accessoria or Waldeyer's artry, however, the Riolan-Haller arch is peculiarly divided so that its maximum dimension is interrupted

For more complete description see section II., page 13.

vessel'' of the enteron is of ample length (one-half to two inches) for ligation, or preferably by clamping by powerful crushing forceps, without compromising the mesenteronic arteries. Each ''straight terminal vessel'' of the enteron bifurcates, one branch passes to the left lateral and the other to the right lateral surface of the enteron, which lies between its diverging branches. The straight terminal vessel of the enteron does not anastomose with adjacent ones in the space between the periphery of the most extended or minimum mesenteronic zone arch of the enteron; however, in the wall of the enteron anastomosis is solid and compact. The ''straight terminal vessel'' of the enteron might be termed ramuli intestini tenuis or, in short, ramuli intestinales. However, this

terminology would not indicate exactly what I designate by the term "*straight terminal vessel" of the enteron*, or vas intestini terminale rectum, which is a vessel extending from peripheral mesentronic arch to the median or mesenteronic border of the enteron.

THE COLIC ARTERIES (Arteriae Colicae).

Dissection. Incise the abdominal wall crucically, reflect the transverse colon proximalward, the right colon rightward and the left colon and sigmoid leftward. Sever the mesenteron at its origin from the jejunal artery (i. e. rami jejunalis) and ileal artery (i. e., rami ileae). Remove the ventral mesocolic blades and the colic arteries will be exposed.. See figures (38), (50), (54), (55), (58), (59), (62), (64).

Nomenclature. I shall adopt the B. N. A. (Nominia Anatomica Basel) nomenclature. Hence the names of the five colic arteries are, I., ileocolic artery (Arteria ileocolica); II., right colic artery (Arteria colica dextra); III., transverse colic artery (Arteria colica transversa); IV., accessory transverse colic artery; (Artera colica transversa accessoria—Waldeyer's artery; V., distal mesenteric artery (Arteria mesenteric distal) see figures (54), (58). From the numerous names applied to the colic arteries I have selected the above as the most rational onomatology.

Distribution. The five colic arteries are distributed to the distal ileum, appendix, coecum, right transverse and left colon, sigmoid and rectum. The distribution to colonic segments is definite but variable in course and form.

Origin. The colic arteries originate from the proximal mesenteric artery and from the distal third of the abdominal aorta.

They originate from the right and ventral port of the proximal mesenteric artery and from the left and ventral surface of the aorta. If there be a concave right side of the proximal mesenteric artery the proximal colic artery originate from it.

The origin of the colic arteries from the proximal mesenteric artery is extremely variable, especially the right, transverse and accessory transverse colic arteries.

The origin of the ileocolic varies the least of the colic arteries. The colic arteries originating from the proximal mesenteric artery may be duplicate, see figures (27), (28), (33), (36), (42).

One might term all the colic arteries from the proximal mesenteric artery, as right colicarteries (Arteriae colica dextrae) and the colic artery originating from the abdominal aorta as the left colic artery (Arteria colica sinistra).

The number of the colic arteries from the proximal mesenteric artery is variable on account of (1) coalescence of branches into a common trunk, and (2), on account of multiplicity of colic arteries.

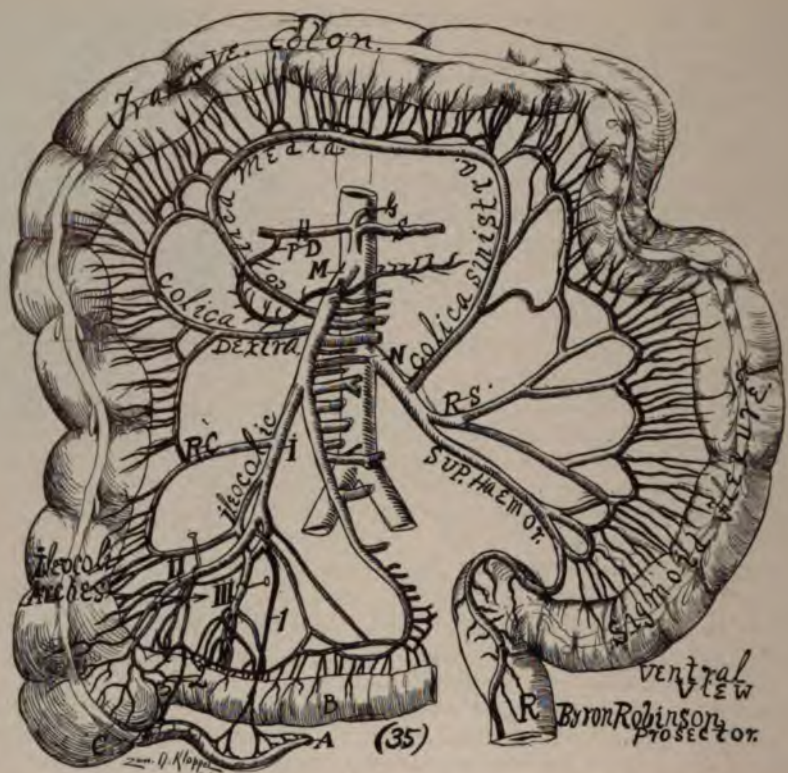
I adopt the plan of four colic arteries from the proximal mesenteric artery, viz., ileocolic, colica dextra, colica transverse, colica transversa accessoria, and the variation of number must be recognized by coalescence or multiplicity.

Course. The colic arteries course to the right colon dorsal to the peritoneum and ventral to ureter and ovarian or spermatic vessels, hence the right colon may be forced ventralward to the median line from the dorsum ,in order to expose the ureter for inspection and surgical procedure.

In performing nephrectomy through the dorsal peritoneum the ileocolic artery or right colic artery should not be ligated or clamped, as colic ulceration or gangrene might ensue.

A safe method to do nephrectomy is to force the right colon toward the median line to avoid ligating or clamping the colic arteries.

The transverse colic arteries course between the transverse mesocolic blades and inosculate with branches of the left colic artery, forming the "entero-colic



APPENDICULAR ARTERY, "ILEOCOLIC CIRCLE," "ILEOCOLIC ARCHES," "STRAIGHT TERMINAL VESSEL," "ENTERO-COLIC CIRCLE," "JEJUNAL ARTERY," "ILEAL ARTERY."

Fig. 35. Ventral view. 1, Arteria appendicularis (primary vessel) a vessel of limited dimension, arises from the right circumference of the "ileocolic circle," i. e., from the ileocolic artery and supplies the free portion of the appendix. 2, arteria appendicularis (secondary vessel) a vessel of limited dimension arises from the arteria ileocecalis ventralis and supplies the base of the appendix. The two appendicular arteries anastomoses as an arch (resembling the mesenteron) and emit ten branches to the appendix.

The "ileocolic circle" is duplicate at the distal extremity. It measures six inches in length and two inches in width.

The "ileocolic arches" numbering 10 are of irregular dimension and caliber. The "jejunal artery" is significant from its relation to splanch noptosia.

There is no arteria transversa accessoria or Waldeyer's artery, i. e., Riolan-Haller's arch is of maximum dimension, not interrupted.

The renal arterial fields are evident. The "straight terminal vessel" is of ample length on colon and enteron for ligature or clamp without compromising the mesocolic or mesenteronic circles.

See section II., page 13.

circle'' or transverse mesocolic arch, which should not be ligated as colic ulceration or gangrene may ensue.

The left colic arteries transverse dorsal to the peritoneum, ventral to the ureter and ovarium or spermatic vessels, hence in left nephrectomy the left colon (and sigmoid) may be forced medianward to expose the ureter for inspection and surgical procedures.

Though the operator attack the kidneys per ventral abdoman it is wise to force the left colon medianward to perform nephrectomy with safety for the branches of the distal mesenteric arteries see figure (38). Accidental ligation

of the distal mesenteric artery or its branch, the left colic would produce ulceration or gagnrene of the left colon.

All colic arteries possess a relatively long trunk and an are relatively adjacent to the colon. They ramify at a considerable distance from the mother trunk, the proximal mesenteric and aorta, forming medium and maximum arcs of circles. The mesenteric branches from medium and minimum arches. The mesocolic arches are located more adjacent to the colon while the mesenteronic arches are located more adjacent to the mother trunk, the proximal mesenteric.

No arteries in the body have been so variably described as the colic arteries. The cause of the various descriptions must lie in (1), actual multiple deviations, but deviations are not anomalies; (2), in the non-correct illustrations; (3), the number of subjects which any single author has observed are insufficient; (4), the error of attempting to follow definite plans, preconceived ideas of types, accounts for errors of description.

The colic arteries form what I shall term proximal, distal "major mesocolic circles."

The "major mesocolic circles" form characteristic circumscribed arterial fields on the dorsal abdominal wall with established visceral relations of practical worth. See arterial fields of the abdomen.

We will consider the proximal colic arteries (Ex arteria mesenteric proximal) in the following order:

Viz., 1, arteria ileocolica; 2, arteria colica dextra; 3, arteria colica transversa; 4, arteria colica transversa accessoria (Waldeyer's artery).

I. ILEOCOLIC ARTERY (Arteria ileocolica).

Dissection. Incise the abdomen crucially, draw the coecum and right colon rightward, and the enteron leftward and distalward, whence by removing the peritoneum from the visible field the ileocolic artery will be exposed. The arteria ileocolica is a constant vessel.

Synonyms. Inferior right colic artery, arteria colica dextra inferior, ileocolic artery. Arteria ileocolica. Ramus iliaca. Arteria coecale. Blind—Grimmdarm Schlagader. Hueft—Grimmdarm Pulsader. Artere ileo-colique. Artere colique inferieure. Artere—ileo-colo-coecole. Artere colique descendante. Artere colique droite inferieure.

Distribution. The ileocolic artery is distributed to right colon, coecum, appendix vermiformis and distal end of ileum, also it inosculates with the distal end of the ileal artery in forming the "ileocolic circle."

Origin. The ileocolic artery originates at the junction of the jejunel artery and ileal artery. It practically arises from the middle of the trunk of the proximal mesenteric artery. It arises opposite the region of the 6th or 7th ramus jejunalis or the 1st ramus ileae. It arises in the region of the origin of the distal mesenteric artery. It arises (minimum) proximal to the origin of the distal mesenteric, see figures (47), (44), (59), (42). It arises (medium) on a level (38). It arises (maximum) distal to the origin of the distal mesenteric artery, see figures (50), (45), (39), (40), (64), (40), (46), (43). The range of origin of the ileocolic artery is extensive.

The significant factor in its origin is that it arises from the junction of the jejunal artery and ileal artery, i. e., it marks the point of division between the jejunal and ileal arteries. Hence it serves as an important and significant anatomic landmark in locating the point of division between the jejunal and ileal arteries. It simplifies a present complex anatomic structure by a simple plan of dividing the jejunal artery from the ileal artery.

Dimension. The arteria ilecolica possesses a diameter at its origin of 1/10 of an inch. Its length from origin to multiple division will average perhaps six inches. It is capable of conducting a considerable volume of blood.

APPENDICULAR ARTERY, "ILEOCOLIC CIRCLE," "ILEO-COLIC ARCHES," "ILEAL ARTERY," "JEJUNAL ARTERY," "STRAIGHT TERMINAL VESSEL," ENTERO-COLIC CIRCLE," "MAJOR MESOCOLIC CIRCLES."

Fig. 36. Ventral view. 1, Arteria appendicularis (primary vessel) a vessal of limited dimension, arises from the right circumference of the "ileocolic circle" (i. e., from the ileo-colic artery) and supplies the main (free) portion of the appendix. 2, arteria appendicularis (secondary vessel), a vessel of limited dimension arises from the arteria ileocecalis dorsalis and supplies the basal portion of the appendix. The two appendicular arteries inosculate to form an arc (a meso-appendicular arch) and emit 20 branches to the appendix.

The "ileocolic circle" is duplicate at its distal extremity.

The "ileocolic arches numbering three are irregular in form and caliber.

There is no Waldeyer artery—the "entero-colic circle" giant or Riolan-Haller arch is uninterrupted. It is surmounted by minor vascular arches.

An artery (H) of marked diameter arises from the jejunal artery (proximal mesenteric) and supplies the liver.

The jejunal artery is of significance as it obstructs the duodenum during the progress of splanchnoptosia resulting in gastro-duodenal dilatation.

The right colic and transverse colic arteries originate closely adjacent and shortly inosculate. See section II., page 13.

Course. The ileocolic artery courses obliquely rightward between the right mesocolic blades in the iliac fossa toward the ileocolic angle. It courses obliquely ventral to the right poas musele and ureter. The course of the ileocolic artery is practically a straight line, extended from its origin at the junction of the jejunal and ileal artery to its destination in the ileocolic angle. The course of the artery is significant in resections of the intestine at the ileocolic angle and surgical work on the ureter. In spare subjects the course of the ileocolic artery

may be recognized by its projecting ridge angle, of peritoneum—a kind of mesangium.

Topography.

The topography of the ileocolic artery may be considered under four divisions, viz.:

Holotopy (relation to general body). The ileocolic artery is located unilaterally in the right distal quadrant of the trunk.

Skeltopy (relation to osseous system). The ileocolic artery is located to the right of the lumbar vertebrae and in the right iliac fossa.

Syntopy (relation to associated viscera). The ileocolic artery is intimately associated with the "ileocolic circle," peritoneum, right psoas muscle, right ureter, coecum, appendix, distal ileum and especially with the appendicular artery. It is a primordial vascular landmark, located at the junction of coecum and ileum. The ileocolic artery is inseparably related to the ileocolic angle. The signification of the ileocolic artery is its syntopic relations to the "ileocolic circle," "ileocolic arches," and origin of the appendicular artery. The ileocolic artery is immortalized in clinical medicine by being the source of blood supply to the dangerous and treacherous appendix.

Idiotopy (relation to component segments). The component segments, the ileocolic artery consists of trunk, branches (ramus colicus, ramus iliacus, ramus ileocoealis—dorsal and ventral), "ileocolic arches," "straight terminal vessel." The trunk of the ileocolic artery extends from its origin at the junction of the jejunal and ileal arteries to the emergence of the ramus colicus. Between the bifurcating branches (ramus colicus and ramus iliacus) is located the "ileocolic arches" and finally the "straight terminal vessel" extends from the "arches" of the ileocolic artery to distal ileum, coecum and proximal colon.

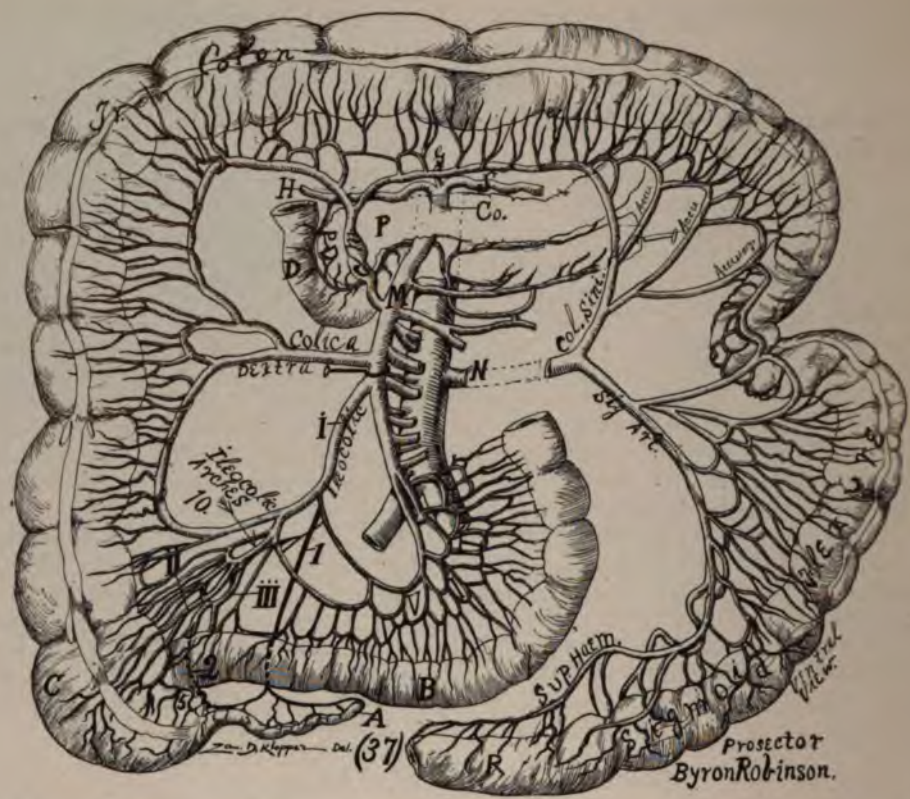
Branches of the Ileocolic Artery.

The arteria ileocolica trifurcates.

Arteria Ilescoliea
- 1 Ramus ileocoecalis dorsal and ventral
- 2 Ramus iliacus
- 3 Ramus coliens

Subdivision
- (a) "Ileocolic circle"
- (b) "Ileocolic arches"
- (c) Straight terminal vessel
- (d) Ramus appendicularis

The division of the ileocolic artery into its three branches (ramus colicus, ramus ileocoecalis and ramus iliacus) is irregular as to location of the trifurcation. It may be stated that the ileocolic artery trifurcates—one branch supplying the right colon, one branch supplying the ileum, and a third, the middle branch, supplying the coecum, however, in another view, the ilecolic artery really bifurcates into ramus colicus and ramus iliacus, while practically in this ileocolic bifurcation is located a series of arches, which I term the "ileocolic arches," which average six for each individual. The "ileocolic arches" are composed by the combined anatsomoses of the dorsal and ventral ileocoecal arteries. The ileocolic artery may bifurcate into ramus iliacus and ramus colicus which emits the ileocolic artery, see figures (46), (47), (57), (64). The reverse of this may occur. For example the ileocolic artery may bifurcate into ramus colicus and ramus iliacus which emits the ileocolic artery, see figures (56), (59), (34), (45), (55).



APPENDICULAR ARTERY, "ILEOCOLIC CIRCLE," "ILEOCOLIC ARCHES," ENTEROCOLIC CIRCLE" (RIOLAN-HALLER ARCH), "STRAIGHT TERMINAL VESSEL." "MAJOR MESOCOLIC CIRCLES," "JEJUNAL," ARTERY," "ILEAL ARTERY."

Fig. 37. Ventral view. Arteria appendicularis (primary vessel) a vessel of limited dimension, arises from the right circumference of the "ileocolic circle" (i. e., from the ileocolic artery (I.) and supplies the main (free) portion of the appendix. 2, arteria appendicularis (secondary vessel) a vessel of limited caliber, arises—III.—from the arteria ileocoecalis dorsalis—(i. e., from the ileocolic arches). The two appendicular arteries inosculate forming a meso-appendicular arch. The two arteries emit ten branches to the appendix.

The ileocolic circle is duplicate at its distal end.

The "ileocolic arches" numbering ten furnish a rich blood supply to the cecum. The jejunal artery is significant on account of its compression of the duodenum and consequent gastro-duodenal dilatation.

There is no arteria transversa accessoria or Waldeyer's artery to interrupt the great Riolan-Haller arch. The areae arteriacae, or arterial fields are evident, especially the renal. See section II., page 13.

We will study the (1) trunk, (2) ramus ileocoecalis, (3) ramus iliacus, (4) ramus colicus and the subordinate structures, (a) "ileocolic arches," (b) ramus appendicularis, (c) "straight terminal vessel."

(1) The Trunk of the Ileocolic Artery.

The trunk of the ileocolic artery begins at the junction of the jejunal and ileal artery and ends at the emergence of the ramus colicus. The trunk of the ileocolic artery emits, first ramus colicus in 80 per cent. and the ramus appendicular first in 20 per cent of subjects. In 54 consecutive subjects the ileocolic

artery emitted the ramus colicus in 80 per cent. previous to the emergence of the ramus colicus.

The trunk of the ileocolic artery is a powerful strong vessel of some 2½ inches in length and ⅛ of an inch in diameter. The trunk of the ileocolic artery is considerably less in volume than its fellow bifurcator—the ileal artery.

The ileocolic trunk is intimately related to the right psoas and ureter.

(2) Ramus Ileocoecalis.

(*A Ventral, B Dorsal.*)

The ileocoecal artery is the medial and strongest continuation of the ileocolic artery. It arises practically at the point of trifurcation of the ileocolic artery. It may be claimed that it occupies (with its "ileocolic arches") the bifurcating angle of the ramus iliacus and ramus colicus. The ileocoecol artery is constant, possessing slight variations and of powerful dimension, coursing obliquely rightward between the mesocolic blade to attend the coecum (and perchance the appendix). In 65 dissections I could constantly locate a larger, shorter straighter dorsal, and a smaller, longer, more curved ventral ileococal branch.

(A) Ventral Ileocoecal Artery.

(*Arteria Ileocoecalis Ventralis.*)

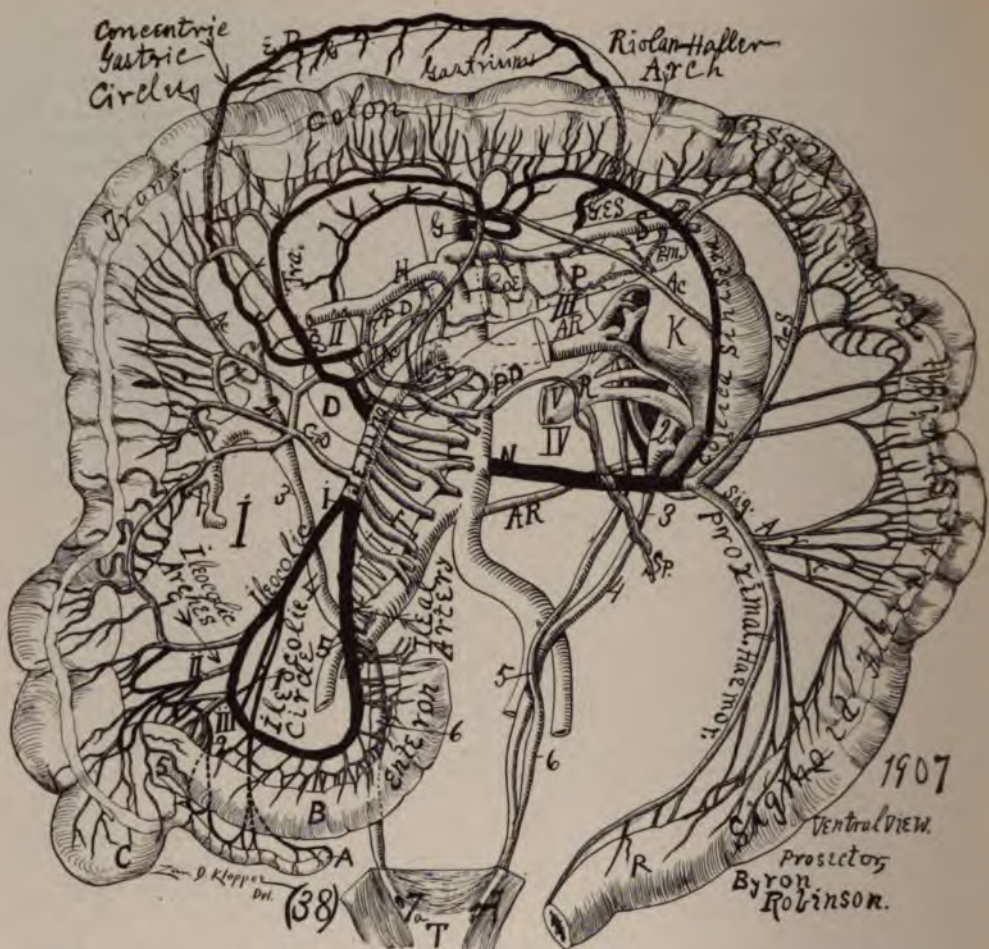
The ventral ileocoecal artery courses obliquely rightward into the ileocolic fold on the ventral surface of the coecum. Practically the ventral ileocaecal artery determines the location and form of the ileocolic fold which protects the vessel from undue tension during coecal distention. The chief branches of the ventral ileocaecol artery course rightward on the ventral folds. The large branch, situated in the coecal depression between the saculae (haustra) emits numerous small branches to supply the coecal saculae or pouches. The ventral ileocaecol artery and its main branches pass between the coecum and taenia coli whence they divide into multiple branches which anastomose with branches from the dorsal ileocaecol artery. The ventral ileocaecol artery may emit several branches, but usually emits one branch of considerable dimensions to the terminal ileum which courses on the surface of the ileum opposite to the mesenteron and parallel to its insertion. The surface of the ileum on the mesenteric side is supplied by branches of limited number and dimension from the "ileocolic circle," see figures (35), (38), (62), (57), (43), (65), (46), (50), (57), (56), (64), (55). From this iliac branch which courses parallel with the terminal ileum small branches course to the ileocoecal fold, that connects with the mesoappendix, where they anastomose with meso-appendicular branches. Hence the ventral ileocoecal artery is frequently solidly and compactly anastomosed with the appendicular artery or arteries, see figures (39), (34), (38), (40), (21), (55), (46), (59), (56), (41), (50), (57), (65), (62).

The ventral ileocoecol artery may originate the appendicular artery which (in all my dissections) coursed dorsal to the ileum. The ventral ileocoecal, artery emits the appendicular artery about three times less frequently than the dorsal ileocoecal artery.

(B) Dorsal Ileocoecal Artery.

(*Arteria ileocoecalis dorsalis.*)

The dorsal ileocoecol artery is a straighter, larger and shorter branch than the ventral ileocoecal. It is not included in the peritoneal fold like the ventral. It pursues a straighter course than the ventral branch. It courses dorsal to the coecum to supply its dorsal surface. The larger branches of the dorsal ileocoecal artery courses in the depression between the coecal haustra and between the coecum and taenia colic whence they divide into multiple branches which anastomose with similar branches from the ventral ileocoecal artery.



APPENDICULAR ARTERY, "ILEOCOLIC CIRCLE," "ILEOCOLIC ARCHES," "STRAIGHT TERMINAL VESSEL," "MAJOR MESOCOLIC CIRCLES." "ENTEROCOLIC CIRCLE." URETERS PARTIALLY DUPLICATE ON THE LEFT SIDE.

Fig. 38. Ventral view. Arteria appendicularis (primary vessel) a vessel of limited dimension, arises from the "ileocolic circle" (i. e., from the ileocolic artery) and supplies the main (free) portion of the appendix. 2, arteria appendicularis (secondary vessel) a vessel of limited dimension, arises from the arteria ileocecalis dorsalis (III). The two appendicular arteries inosculate forming an arch—a meso-appendicular arch (resembling a mesocolic or mesenteron) and emit 11 branches to the appendix.

The relation of the "ileocolic circle" to the ureter, common iliacs and ileocolic angle is evident. Note the series of imposed arches on the periphery of the "ileocolic circle."

The "ileocolic arches" numbering 9 are irregular in form, dimension and in the caliber of the anastomosing arteries. The "jejunal artery" is important on account of its relation to gastro-duodenal dilatation.

The Riolan-Haller arch is interrupted by the arteria transversa colica accessoria (Waldeyer's artery). The arteria colica dextra et sinistra are peculiarly inosculated. The celiac axis is solidly anastomosed to the proximal mesenteric artery. The areae arteriacae are evident, practically circumscribing a renal field. See section II., page 13.

The dorsal ileocoecal artery may originate the appendicular artery. It originated the appendicular artery about three times more frequent than the ventral ileocoecol artery. The dorsal ileocoecol artery not only supplied the dorsal

wall of the coecum but passed ventralward over the medial line to supply part of the ventral coecal wall and eventually to anastomose with the branches of the ventral ileocoecal artery. The dorsal ileocoecal artery emits branches of greater caliber and number than the ventral ileocoecal. The dorsal ileocoecal artery is a strong powerful vessel conducting a large quantity of blood. The ilecoecal artery with its larger, longer and straighter dorsal branches and with its smaller, shorter and more curved ventral branch indicates a primordial vascular landmark—attending an ancient vort structure, the coecum and appendix (a second stomach). This vascular ileocolic landmark is rendered more evident and significant from the fact that the dorsal and ventral ileocoecol arteries combine in anastomotic apparatus which I term the "ileocolic arch," averaging six arches for each individual.

The ileocoecal artery is the main central, continuation of the ileocolic artery while the ramus iliacus and ramus colicus are the inosculating branches which connect the ileum and colon with the coecum.

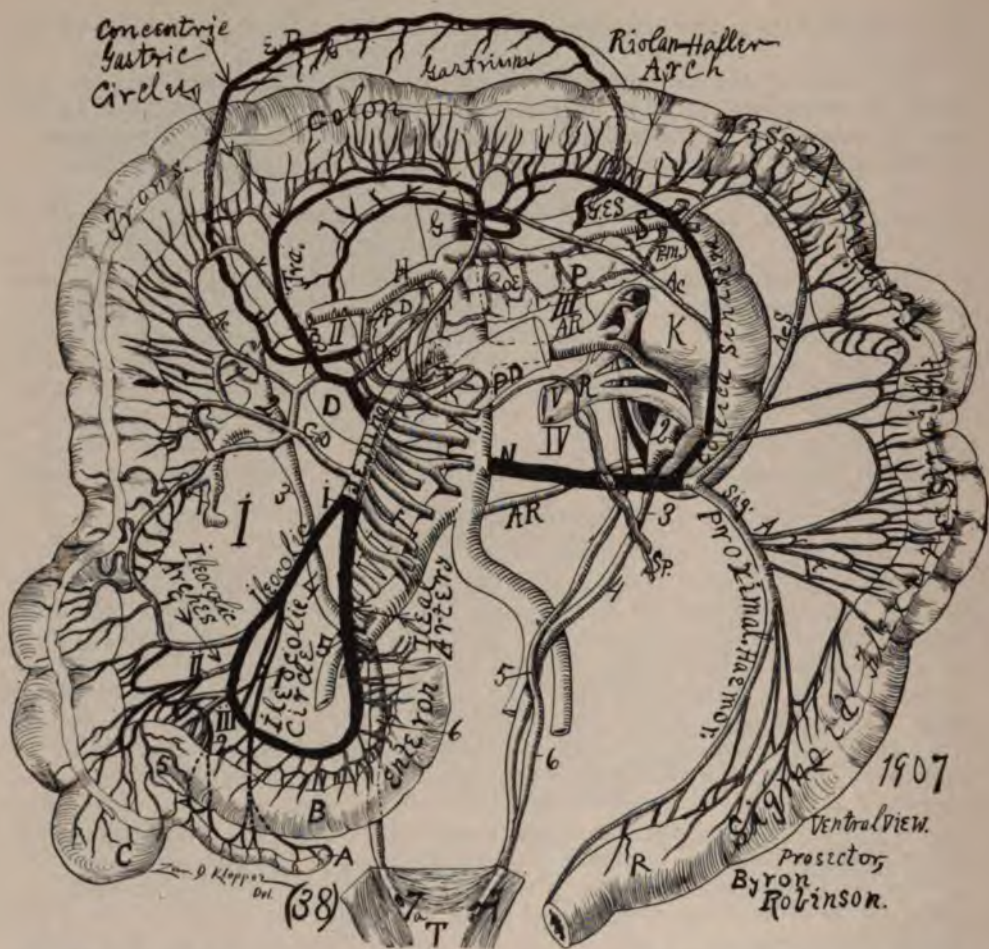
(3) Ramus Iliacus of the Ileocolic Artery.

The ramus iliacus practically courses from the point of ileocolic trifurcation or from the arteria ileocolica distalward and leftward between the blades of the mesenteric with the ileal artery (approaching the "ileocolic circle"). The first quarter of the course of the iliac branch (ramus iliacus) is peculiarly free from branches, the last three quarters of its course presents numerous, perhaps half a dozen small, short, thin, terminal straight vessels which supply the distal ileum; these are the "straight terminal vessels." Also theramus iliacus may possess or have imposed on its circumferences a series of minor vascular arches from which emerge the "straight terminal vessel" to supply the terminal ileum. The "straight terminal vessel" of the ileum is so limited in calibre and number and it subjects the ileum from minimum quantity of blood, to disease, tuberculosis, typhoid ulceration. In numerous subjects the ileocolic artery possesses a short trunk with premature bifurcation into ramus colicus and ramus iliacus, see figures (46), (47), (55), (62), (64), (65). The ramus iliacus of the ileocolic artery is the distinct inosculating branch which connects the enteronic arteries with those of the coecum (and appendix). The ramus iliacus is significant as it emits the "straight terminal vessel"—perchance a half a dozen—to the distal end of the ileum which is the location of grave diseases, such as tuberculosis, typhoid ulceration. The distal ileum receives the least quantity of blood of any segment of the tractus intestinalis except the appendix.

(4) Ramus Colicus of the Ileocolic Artery.

The ramus colicus is a strong, powerful branch, variable in course, origin, diameter and length. It courses rightward between the right mesocolic blade to supply the richt colon and coecum. Its main branches inosculate with a similar branch from the colico dextra, producing, in all my dissections a constant vascular circle, which I term the "distal right mesocolic circle" or arch.

The emergence of the ramus colicus from the ileocolic artery and the junction of the jejunal and ileal artery mark the limit or length of the ileocolic trunk. Not infrequently the ramus colicus courses to the middle of the ventral surface of the right colon to inosculate with a similar branch from the colica dextra (see sig. (38), (41), (43), (47), (62), (64). However, it will be evident on inspection that the "straight terminal vessel" is of ample length to be clamped or ligated without compromising the "distal right mesocolic circle," which might jeopardize the right colon to ulceration or gangrene. Should the right border of the "distal right mesocolic circle," extend to the ventral surface of the right colon, slight, blunt, dissection facilitates the exposure and freedom



APPENDICULAR ARTERY, "ILEOCOLIC CIRCLE," "ILEOCOLIC ARCHES," "STRAIGHT TERMINAL VESSEL," "MAJOR MESOCOLIC CIRCLES." "ENTEROCOLIC CIRCLE." URETERS PARTIALLY DUPLICATE ON THE LEFT SIDE.

Fig. 38. Ventral view. Arteria appendicularis (primary vessel) a vessel of limited dimension, arises from the "ileocolic circle" (i. e., from the ileocolic artery) and supplies the main (free) portion of the appendix. 2, arteria appendicularis (secondary vessel) a vessel of limited dimension, arises from the arteria ileocecalis dorsalis (III). The two appendicular arteries inosculate forming an arch—a meso-appendicular arch (resembling a mesocolic or mesenteron) and emit 11 branches to the appendix.

The relation of the "ileocolic circle" to the ureter, common iliacs and ileocolic angle is evident. Note the series of imposed arches on the periphery of the "ileocolic circle."

The "ileocolic arches" numbering 9 are irregular in form, dimension and in the caliber of the anastomosing arteries. The "jejunal artery" is important on account of its relation to gastro-duodenal dilatation.

The Riolan-Haller arch is interrupted by the arteria transversa colica accessoria (Waldeyer's artery). The arteria colica dextra et sinistra are peculiarly inosculated. The celiac axis is solidly anastomosed to the proximal mesenteric artery. The areae arteriacae are evident, practically circumscribing a renal field. See section II., page 13.

The dorsal ileocoecal artery may originate the appendicular artery. It originated the appendicular artery about three times more frequent than the ventral ileocoecol artery. The dorsal ileocoecol artery not only supplied the dorsal

wall of the coecum but passed ventralward over the medial line to supply part of the ventral coecal wall and eventually to anastomose with the branches of the ventral ileocoecal artery. The dorsal ileocoecal artery emits branches of greater caliber and number than the ventral ileocoecal. The dorsal ileocoecal artery is a strong powerful vessel conducting a large quantity of blood. The ilecoecal artery with its larger, longer and straighter dorsal branches and with its smaller, shorter and more curved ventral branch indicates a primordial vascular landmark—attending an ancient vort structure, the coecum and appendix (a second stomach). This vascular ileocolic landmark is rendered more evident and significant from the fact that the dorsal and ventral ileocoecol arteries combine in anastomotic apparatus which I term the "ileocolic arch," averaging six arches for each individual.

The ileocoecal artery is the main central, continuation of the ileocolic artery while the ramus iliacus and ramus colicus are the inosculating branches which connect the ileum and colon with the coecum.

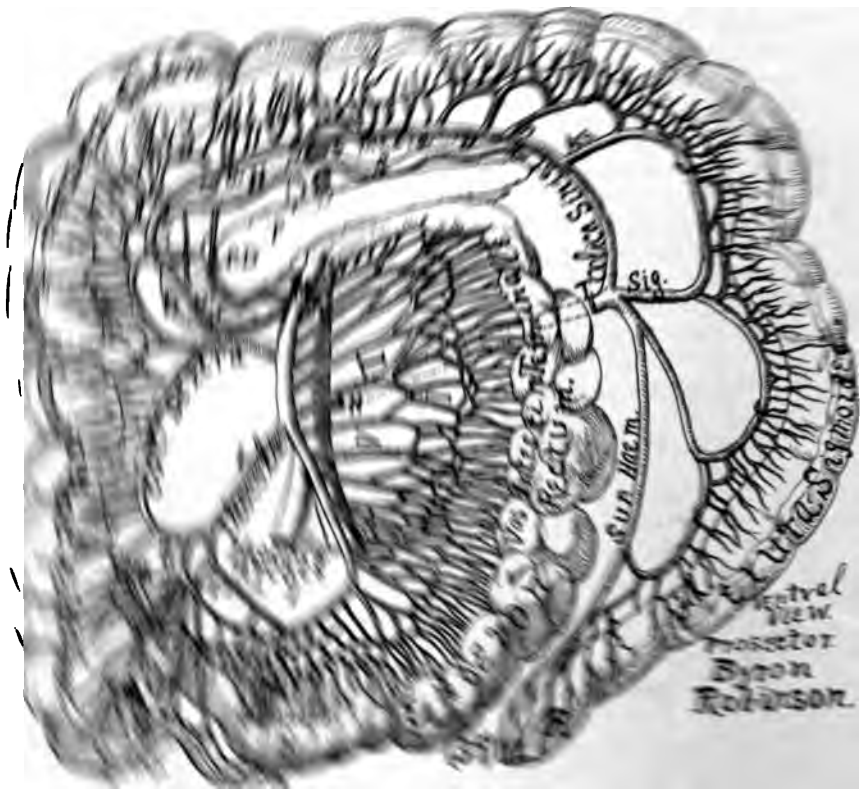
(3) Ramus Iliacus of the Ileocolic Artery.

The ramus iliacus practically courses from the point of ileocolic trifurcation or from the arteria ileocolica distalward and leftward between the blades of the mesenteric with the ileal artery (approaching the "ileocolic circle"). The first quarter of the course of the iliac branch (ramus iliacus) is peculiarly free from branches, the last three quarters of its course presents numerous, perhaps half a dozen small, short, thin, terminal straight vessels which supply the distal ileum; these are the "straight terminal vessels." Also theramus iliacus may possess or have imposed on its circumferences a series of minor vascular arches from which emerge the "straight terminal vessel" to supply the terminal ileum. The "straight terminal vessel" of the ileum is so limited in calibre and number and it subjects the ileum from minimum quantity of blood, to disease, tuberculosis, typhoid ulceration. In numerous subjects the ileocolic artery possesses a short trunk with premature bifurcation into ramus colicus and ramus iliacus, see figures (46), (47), (55), (62), (64), (65). The ramus iliacus of the ileocolic artery is the distinct inosculating branch which connects the enteronic arteries with those of the coecum (and appendix). The ramus iliacus is significant as it emits the "straight terminal vessel"—perchance a half a dozen—to the distal end of the ileum which is the location of grave diseases, such as tuberculosis, typhoid ulceration. The distal ileum receives the least quantity of blood of any segment of the tractus intestinalis except the appendix.

(4) Ramus Colicus of the Ileocolic Artery.

The ramus colicus is a strong, powerful branch, variable in course, origin, diameter and length. It courses rightward between the right mesocolic blade to supply the richt colon and coecum. Its main branches inosculate with a similar branch from the colico dextra, producing, in all my dissections a constant vascular circle, which I term the "distal right mesocolic circle" or arch.

The emergence of the ramus colicus from the ileocolic artery and the junction of the jejunal and ileal artery mark the limit or length of the ileocolic trunk. Not infrequently the ramus colicus courses to the middle of the ventral surface of the right colon to inosculate with a similar branch from the colica dextra (see sig. (38), (41), (43), (47), (62), (64). However, it will be evident on inspection that the "straight terminal vessel" is of ample length to be clamped or ligated without compromising the "distal right mesocolic circle," which might jeopardize the right colon to ulceration or gangrene. Should the right border of the "distal right mesocolic circle," extend to the ventral surface of the right colon, slight, blunt, dissection facilitates the exposure and freedom


Sig.
Sup. Haem.
Pelvic View
Dissector
Dyson
Robinson

ease—such as tuberculosis, resection, typhoid ulceration, malignancy—requiring colonic resection.

II. RIGHT COLIC ARTERY.

(Arteria Colica Dextra).

Dissection. Make a crucial abdominal incision, reflect the enteron leftward and the right colon rightward, whence the peritoneum covering the right colic artery is exposed.

Synonyms. Arteria colica dextra, right colic artery. Arteria colica media dextra, right middle colic artery. Superior right colic artery. Artere colique droite moyenne. Artere meso colique. Rechte Grimmdarm Pulsader. Rechte Grimmdarm Schlagader.

Origin. The arteria colica dextra presents perhaps more variation in its origin than any other artery. It arose from the 41 subjects as follows, viz.:

(1) It arose separately or independently from the jejunal artery or from the proximal mesenteric artery between the arteria ileo-colica and arteria colica transversa 43 per cent.

(2) It arose as a common trunk with the arteria ileo-colica—20 per cent.

(3) It arose as a common trunk with the arteria colica transversa 37 per cent. By consulting 50 current text books of anatomy it will become apparent that one frequently copies the other. However, there will be noted two groups of anatomists, viz., one group maintains three arteriae colicae which originate separately, from the jejunal artery (or from the proximal mesenteric artery) or at least two originate with a common trunk. These colic arteries have been designated by various names as prima, secunda, tertia,—or as superior, media and inferior. I shall name these three colic arteries as arteria ileo-colica, arteria colica dextra, and arteria colica transversa to accord with rational nomenclature. Some 20 anatomists have adopted this plan of the colic arteries, but not the names. Of the group of anatomists accepting the above plan I think Dr. Frederick Wilhelm Theile, (German anatomist, 1781-1861, professor in Jena), presents the most suugestive and accurate description of the origin of the arteria colica dextra. Theile says, in substance, that the arteria colica dextra arises *now* from the proximal mesenteric artery proximal to the arteria ileo-colica (i e. from the jejunal artery) *now* it is a branch of the arteria colica transversa, *now* it arises from the arteria ileo-colica. Theile was one of the most accurate anatomists of his day. I dissected 65 consecutive subjects and found the conditions as reported, viz., the arteria colica dextra arises 43 per cent., independently, separately from the jejunal artery (or from the arteria mesenterica proximal), 37 per cent. from a common trunk with the arteria colica transversa, and 20 per cent. from a common trunk with the arteria ileo-colica. Some latitude of judgment and personal equation must be allowed to these estimations.

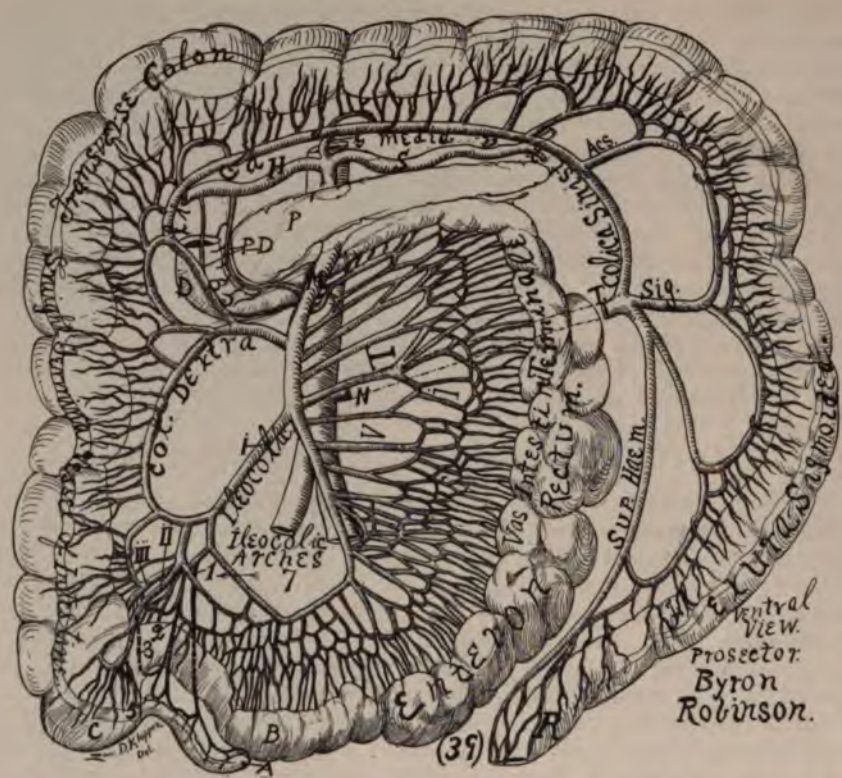
A second group of anatomists assume a different type for the arteriae colicae, viz., this group assumes two arteriae colicae, viz.:

(1) Arteria colica dextra, and

(2) Arteria colica transversa.

These anatomists assume that the arteria ileo-colica is merely an end branch of the arteria mesenterica proximal. A half dozen anatomic authors can be found adopting this plan. I emphatically object to this plan because I never found the arteria ileo-colica absent. The arteria ileo-colica is constant, as it nourishes what was once a maximum herbivorous stomach—now the atrophying, dangerous, treacherous, appendix. Hyrtl and Gegenbauer have not committed themselves to any plans. A majority of anatomists assert:

First, that the arteria colica dextra arises as a common trunk with the arteria ileo-colica (the rule), and,



APPENDICULAR ARTERY, "ILEOCOLIC CIRCLE," "ILEOCOLIC ARCHES," "STRAIGHT TERMINAL VESSEL," "ILEAL ARTERY," "JEJUNAL ARTERY," "MAJOR MESOCOLIC CIRCLE," "ENTERO-COLIC CIRCLE."

Fig. 39. Ventral view. 1, Arteria appendicularis (primary vessel) a vessel of limited caliber arises from the right circumference of the ileocolic circle (i. e., from the ileocolic artery, I.) and supplies the main (free) portion of the appendix. 2, arteria appendicularis (secondary vessel), a vessel of limited caliber, arising from the right circumference of the ileocolic circle (i. e., from the ileocolic artery and supplies the middle portion of the appendix. 3, arteria appendicularis (tertiary vessel) a vessel of limited caliber arises from the arteria ileocecalis ventralis (i. e., from the ileocolic arches). The three appendicular arteries inosculate forming meso-appendicular arches and emits nine branches to the appendix.

The ileocolic circle is duplicate at its distal end and of limited dimension on account of the distalward bifurcation of the trunk of the proximal mesenteric artery.

The ileocolic arches, numbering 7 are limited in dimension, but of maximum caliber in anastomosis.

"Enterocolic circle" or the Riolan-Haller arch is not interrupted by a Waldeyer's artery. It has imposed on its circumference a series of minor arches.

The "jejunal artery" is significant on account of its compression and obstruction of the duodenum during the progress of splanchnoptosia and consequent gastro-duodenal dilation.

See section II., page 13.

of the "straight terminal vessel" amply sufficient for the clamp or ligature without compromising the mesocolic circle.

The ramus colicus distributes itself to the right colon, inosculating with a branch from the colica dextra. The ramus colicus of the ileocolic artery is the distinct inosculating vessel which unites the arteries of the colon with those of the coecum (and appendix). The ramus colicus of the ileocolic artery is significant as it supplies the proximal right colon, the frequent seat of grave dis-

ease—such as tuberculosis, resection, typhoid ulceration, malignancy—requiring colonic resection.

II. RIGHT COLIC ARTERY.

(Arteria Colica Dextra).

Dissection. Make a crucial abdominal incision, reflect the enteron leftward and the right colon rightward, whence the peritoneum covering the right colic artery is exposed.

Synonyms. Arteria colica dextra, right colic artery. Arteria colica media dextra, right middle colic artery. Superior right colic artery. Artere colique droite moyenne. Artere meso colique. Rechte Grimmdarm Pulsader. Rechte Grimmdarm Schlagader.

Origin. The arteria colica dextra presents perhaps more variation in its origin than any other artery. It arose from the 41 subjects as follows, viz.:

(1) It arose separately or independently from the jejunal artery or from the proximal mesenteric artery between the arteria ileo-colica and arteria colica transversa 43 per cent.

(2) It arose as a common trunk with the arteria ileo-colica—20 per cent.

(3) It arose as a common trunk with the arteria colica transversa 37 per cent. By consulting 50 current text books of anatomy it will become apparent that one frequently copies the other. However, there will be noted two groups of anatomists, viz., one group maintains three arteriae colicae which originate separately, from the jejunal artery (or from the proximal mesenteric artery) or at least two originate with a common trunk. These colic arteries have been designated by various names as prima, secunda, tertia,—or as superior, media and inferior. I shall name these three colic arteries as arteria ileo-colica, arteria colica dextra, and arteria colica transversa to accord with rational nomenclature. Some 20 anatomists have adopted this plan of the colic arteries, but not the names. Of the group of anatomists accepting the above plan I think Dr. Frederick Wilhelm Theile, (German anatomist, 1781-1861, professor in Jena), presents the most suugestive and accurate description of the origin of the arteria colica dextra. Theile says, in substance, that the arteria colica dextra arises *now* from the proximal mesenteric artery proximal to the arteria ileo-colica (i e. from the jejunal artery) *now* it is a branch of the arteria colica transversa, *now* it arises from the arteria ileo-colica. Theile was one of the most accurate anatomists of his day. I dissected 65 consecutive subjects and found the conditions as reported, viz., the arteria colica dextra arises 43 per cent., independently, separately from the jejunal artery (or from the arteria mesenterica proximal), 37 per cent. from a common trunk with the arteria colica transversa, and 20 per cent. from a common trunk with the arteria ileo-colica. Some latitude of judgment and personal equation must be allowed to these estimations.

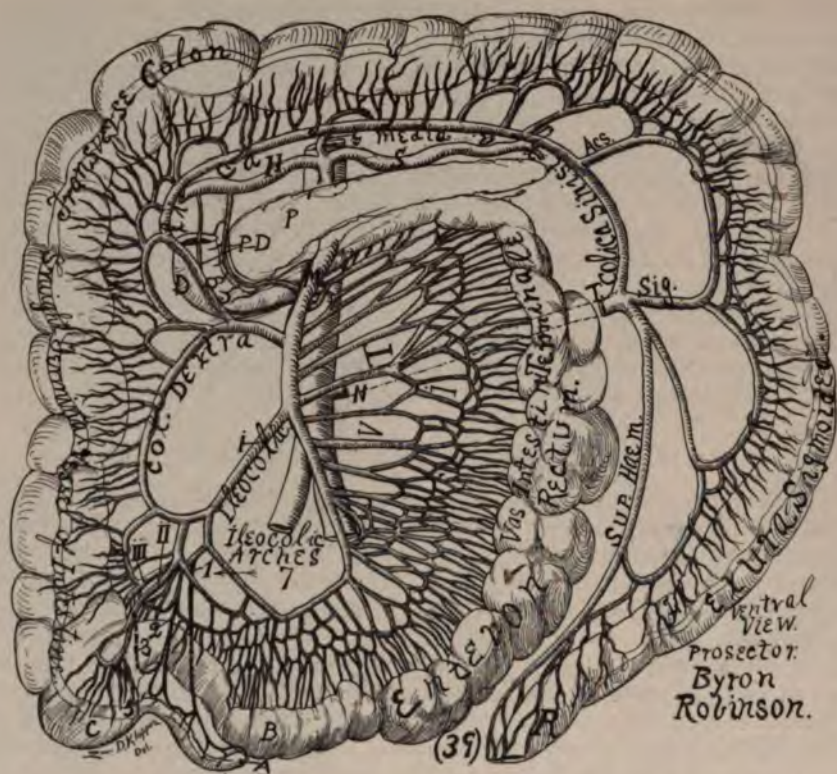
A second group of anatomists assume a different type for the arteriae colicae, viz., this group assumes two arteriae colicae, viz.:

(1) Arteria colica dextra, and

(2) Arteria colica transversa.

These anatomists assume that the arteria ileo-colica is merely an end branch of the arteria mesenterica proximal. A half dozen anatomic authors can be found adopting this plan. I emphatically object to this plan because I never found the arteria ileo-colica absent. The arteria ileo-colica is constant, as it nourishes what was once a maximum herbivorous stomach—now the atrophying, dangerous, treacherous, appendix. Hyrtl and Gegenbauer have not committed themselves to any plans. A majority of anatomists assert:

First, that the arteria colica dextra arises as a common trunk with the arteria ileo-colica (the rule), and,



APPENDICULAR ARTERY, "ILEOCOLIC CIRCLE," "ILEOCOLIC ARCHES," "STRAIGHT TERMINAL VESSEL," "ILEAL ARTERY," "JEJUNAL ARTERY," "MAJOR MESOCOLIC CIRCLE," "ENTERO-COLIC CIRCLE."

Fig. 39. Ventral view. 1, Arteria appendicularis (primary vessel) a vessel of limited caliber arises from the right circumference of the ileocolic circle (i. e., from the ileocolic artery, I.) and supplies the main (free) portion of the appendix. 2, arteria appendicularis (secondary vessel), a vessel of limited caliber, arising from the right circumference of the ileocolic circle (i. e., from the ileocolic artery and supplies the middle portion of the appendix. 3, arteria appendicularis (tertiary vessel) a vessel of limited caliber arises from the arteria ileocecalis ventralis (i. e., from the ileocolic arches). The three appendicular arteries inosculate forming meso-appendicular arches and emits nine branches to the appendix.

The ileocolic circle is duplicate at its distal end and of limited dimension on account of the distalward bifurcation of the trunk of the proximal mesenteric artery.

The ileocolic arches, numbering 7 are limited in dimension, but of maximum caliber in anastomosis.

"Enterocolic circle" or the Riolan-Haller arch is not interrupted by a Waldeyer's artery. It has imposed on its circumference a series of minor arches.

The "jejunal artery" is significant on account of its compression and obstruction of the duodenum during the progress of splanchnoptosia and consequent gastro-duodenal dilation.

See section II., page 13.

of the "straight terminal vessel" amply sufficient for the clamp or ligature without compromising the mesocolic circle.

The ramus colicus distributes itself to the right colon, inosculating with a branch from the colica dextra. The ramus colicus of the ileocolic artery is the distinct inosculating vessel which unites the arteries of the colon with those of the coecum (and appendix). The ramus colicus of the ileocolic artery is significant as it supplies the proximal right colon, the frequent seat of grave dis-

ease—such as tuberculosis, resection, typhoid ulceration, malignancy—requiring colonic resection.

II. RIGHT COLIC ARTERY.

(Arteria Colica Dextra).

Dissection. Make a crucial abdominal incision, reflect the enteron leftward and the right colon rightward, whence the peritoneum covering the right colic artery is exposed.

Synonyms. Arteria colica dextra, right colic artery. Arteria colica media dextra, right middle colic artery. Superior right colic artery. Artere colique droite moyenne. Artere meso colique. Rechte Grimmdarm Pulsader. Rechte Grimmdarm Schlagader.

Origin. The arteria colica dextra presents perhaps more variation in its origin than any other artery. It arose from the 41 subjects as follows, viz.:

(1) It arose separately or independently from the jejunal artery or from the proximal mesenteric artery between the arteria ileo-colica and arteria colica transversa 43 per cent.

(2) It arose as a common trunk with the arteria ileo-colica—20 per cent.

(3) It arose as a common trunk with the arteria colica transversa 37 per cent. By consulting 50 current text books of anatomy it will become apparent that one frequently copies the other. However, there will be noted two groups of anatomists, viz., one group maintains three arteriae colicae which originate separately, from the jejunal artery (or from the proximal mesenteric artery) or at least two originate with a common trunk. These colic arteries have been designated by various names as prima, secunda, tertia,—or as superior, media and inferior. I shall name these three colic arteries as arteria ileo-colica, arteria colica dextra, and arteria colica transversa to accord with rational nomenclature. Some 20 anatomists have adopted this plan of the colic arteries, but not the names. Of the group of anatomists accepting the above plan I think Dr. Frederick Wilhelm Theile, (German anatomist, 1781-1861, professor in Jena), presents the most suugestive and accurate description of the origin of the arteria colica dextra. Theile says, in substance, that the arteria colica dextra arises *now* from the proximal mesenteric artery proximal to the arteria ileo-colica (i e. from the jejunal artery) *now* it is a branch of the arteria colica transversa, *now* it arises from the arteria ileo-colica. Theile was one of the most accurate anatomists of his day. I dissected 65 consecutive subjects and found the conditions as reported, viz., the arteria colica dextra arises 43 per cent., independently, separately from the jejunal artery (or from the arteria mesenterica proximal), 37 per cent. from a common trunk with the arteria colica transversa, and 20 per cent. from a common trunk with the arteria ileo-colica. Some latitude of judgment and personal equation must be allowed to these estimations.

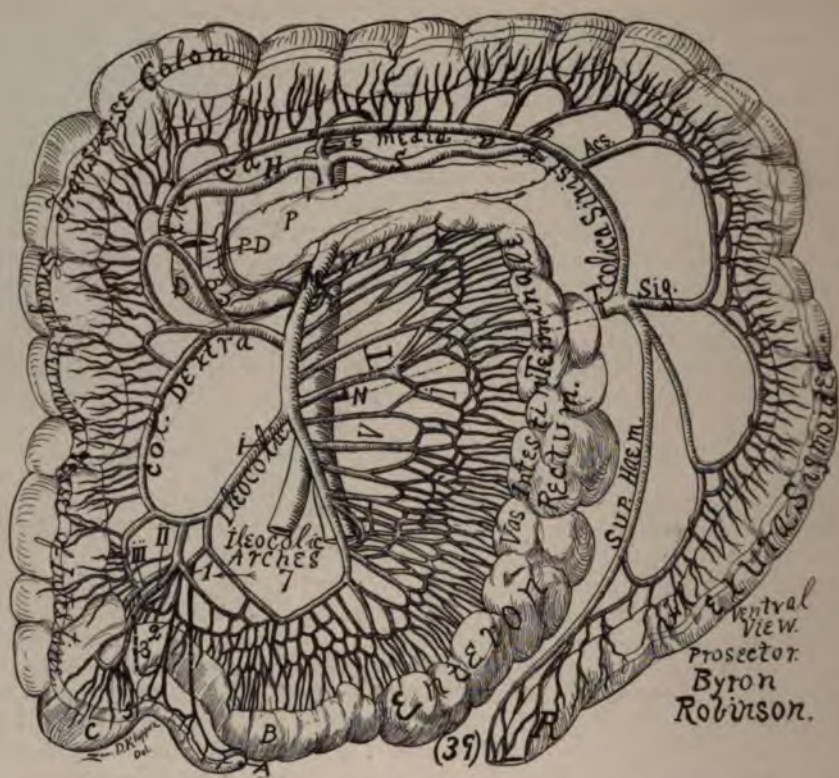
A second group of anatomists assume a different type for the arteriae colicae, viz., this group assumes two arteriae colicae, viz.:

(1) Arteria colica dextra, and

(2) Arteria colica transversa.

These anatomists assume that the arteria ileo-colica is merely an end branch of the arteria mesenterica proximal. A half dozen anatomic authors can be found adopting this plan. I emphatically object to this plan because I never found the arteria ileo-colica absent. The arteria ileo-colica is constant, as it nourishes what was once a maximum herbivorous stomach—now the atrophying, dangerous, treacherous, appendix. Hyrtl and Gegenbauer have not committed themselves to any plans. A majority of anatomists assert:

First, that the arteria colica dextra arises as a common trunk with the arteria ileo-colica (the rule), and,



APPENDICULAR ARTERY, "ILEOCOLIC CIRCLE," "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL," "ILEAL ARTERY," "JEJUNAL ARTERY," "MAJOR MESOCOLIC CIRCLE," "ENTERO-COLIC CIRCLE."

Fig. 39. Ventral view. 1, Arteria appendicularis (primary vessel) a vessel of limited caliber arises from the right circumference of the ileocolic circle (i. e., from the ileocolic artery, I.) and supplies the main (free) portion of the appendix. 2, arteria appendicularis (secondary vessel), a vessel of limited caliber, arising from the right circumference of the ileocolic circle (i. e., from the ileocolic artery and supplies the middle portion of the appendix. 3, arteria appendicularis (tertiary vessel) a vessel of limited caliber arises from the arteria ileocecalis ventralis (i. e., from the ileocolic arches). The three appendicular arteries inosculate forming meso-appendicular arches and emits nine branches to the appendix.

The ileocolic circle is duplicate at its distal end and of limited dimension on account of the distalward bifurcation of the trunk of the proximal mesenteric artery.

The ileocolic arches, numbering 7 are limited in dimension, but of maximum caliber in anastomosis.

"Enterocolic circle" or the Riolan-Haller arch is not interrupted by a Waldeyer's artery. It has imposed on its circumference a series of minor arches.

The "jejunal artery" is significant on account of its compression and obstruction of the duodenum during the progress of splanchnoptosia and consequent gastro-duodenal dilation.

See section II., page 13.

of the "straight terminal vessel" amply sufficient for the clamp or ligature without compromising the mesocolic circle.

The ramus colicus distributes itself to the right colon, inosculating with a branch from the colica dextra. The ramus colicus of the ileocolic artery is the distinct inosculating vessel which unites the arteries of the colon with those of the coecum (and appendix). The ramus colicus of the ileocolic artery is significant as it supplies the proximal right colon, the frequent seat of grave dis-

ease—such as tuberculosis, resection, typhoid ulceration, malignancy—requiring colonic resection.

II. RIGHT COLIC ARTERY.

(Arteria Colica Dextra).

Dissection. Make a crucial abdominal incision, reflect the enteron leftward and the right colon rightward, whence the peritoneum covering the right colic artery is exposed.

Synonyms. Arteria colica dextra, right colic artery. Arteria colica media dextra, right middle colic artery. Superior right colic artery. Artere colique droite moyenne. Artere meso colique. Rechte Grimmdarm Pulsader. Rechte Grimmdarm Schlagader.

Origin. The arteria colica dextra presents perhaps more variation in its origin than any other artery. It arose from the 41 subjects as follows, viz.:

(1) It arose separately or independently from the jejunal artery or from the proximal mesenteric artery between the arteria ileo-colica and arteria colica transversa 43 per cent.

(2) It arose as a common trunk with the arteria ileo-colica—20 per cent.

(3) It arose as a common trunk with the arteria colica transversa 37 per cent. By consulting 50 current text books of anatomy it will become apparent that one frequently copies the other. However, there will be noted two groups of anatomists, viz., one group maintains three arteriae colicae which originate separately, from the jejunal artery (or from the proximal mesenteric artery) or at least two originate with a common trunk. These colic arteries have been designated by various names as prima, secunda, tertia,—or as superior, media and inferior. I shall name these three colic arteries as arteria ileo-colica, arteria colica dextra, and arteria colica transversa to accord with rational nomenclature. Some 20 anatomists have adopted this plan of the colic arteries, but not the names. Of the group of anatomists accepting the above plan I think Dr. Frederick Wilhelm Theile, (German anatomist, 1781-1861, professor in Jena), presents the most suugestive and accurate description of the origin of the arteria colica dextra. Theile says, in substance, that the arteria colica dextra arises *now* from the proximal mesenteric artery proximal to the arteria ileo-colica (i e. from the jejunal artery) *now* it is a branch of the arteria colica transversa, *now* it arises from the arteria ileo-colica. Theile was one of the most accurate anatomists of his day. I dissected 65 consecutive subjects and found the conditions as reported, viz., the arteria colica dextra arises 43 per cent., independently, separately from the jejunal artery (or from the arteria mesenterica proximal), 37 per cent. from a common trunk with the arteria colica transversa, and 20 per cent. from a common trunk with the arteria ileo-colica. Some latitude of judgment and personal equation must be allowed to these estimations.

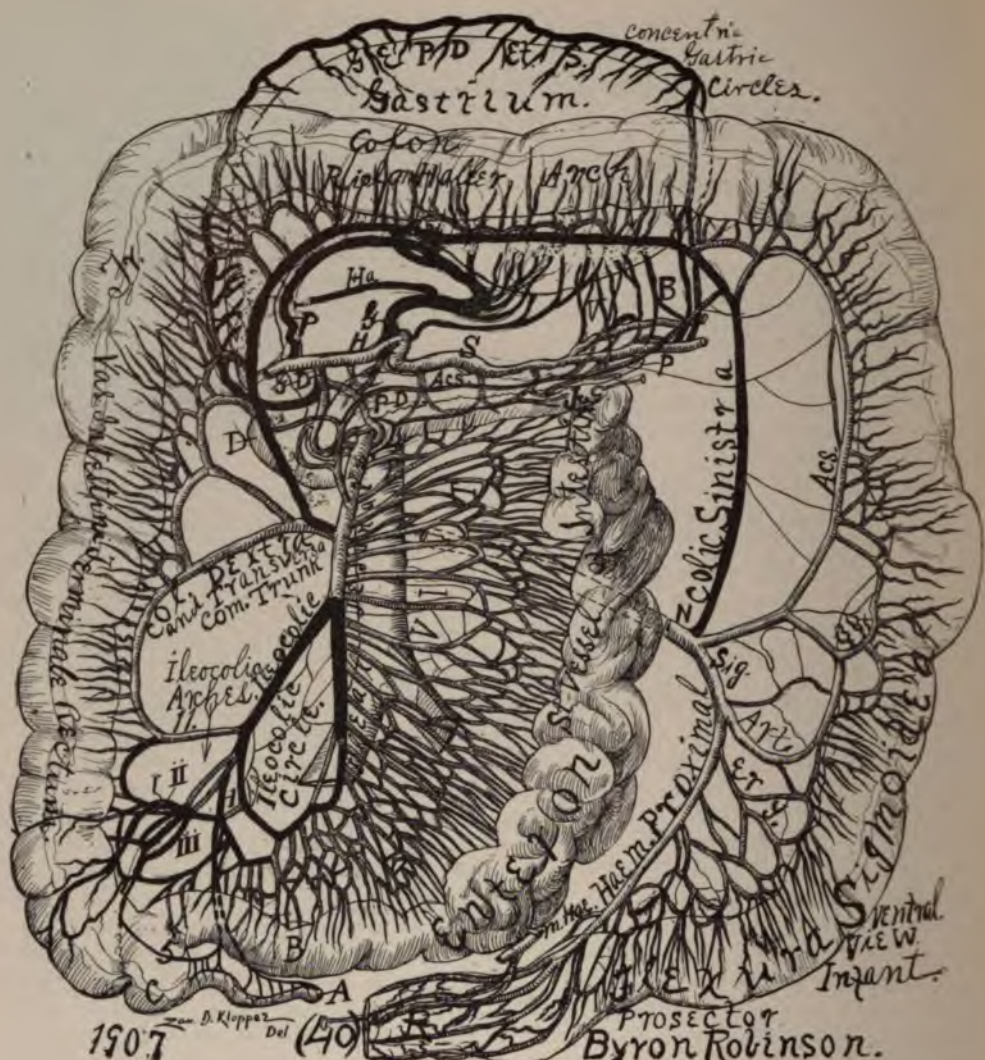
A second group of anatomists assume a different type for the arteriae colicae, viz., this group assumes two arteriae colicae, viz.:

(1) Arteria colica dextra, and

(2) Arteria colica transversa.

These anatomists assume that the arteria ileo-colica is merely an end branch of the arteria mesenterica proximal. A half dozen anatomic authors can be found adopting this plan. I emphatically object to this plan because I never found the arteria ileo-colica absent. The arteria ileo-colica is constant, as it nourishes what was once a maximum herbivorous stomach—now the atrophying, dangerous, treacherous, appendix. Hyrtl and Gegenbauer have not committed themselves to any plans. A majority of anatomists assert:

First, that the arteria colica dextra arises as a common trunk with the arteria ileo-colica (the rule), and,



APPENDICULAR ARTERY, "ILEOCOLIC CIRCLE," "ILEOCOLIC ARCHES," "STRAIGHT TERMINAL VESSEL," "ILEAL ARTERY," "JEJUNAL ARTERY," ENTERO-COLIC CIRCLE" "MAJOR MESOCOLIC CIRCLE."

Fig. 40. Ventral view. 1, Arteria appendicularis, a single vessel of limited caliber arises from the right circumference of the "ileocolic circle" (i. e., from the ileo-colic artery) and supplies the appendix with 11 branches. Perhaps it more correctly from the ileocoecal artery.

The "ileocolic circle" originates the appendicular artery from its right circumference. Though the ileocolic circle in this subject was of limited dimension, area, its mesentery within the circle is richly nourished by cross arteries. In this subject the ileocolic circle is limited in dimension from elongation of the trunk of the proximal mesenteric artery.

The "ileocolic arches" numbering 11, are varied in form, dimension and caliber of anastomatic vessels. They resemble the sigmoid arches. They present an isolated, independent apparatus anastomosed on the one hand to the colic arteries and on the other hand with the neteronic arteries.

The "entero-colic circle" or the giant Riolan-Haller arch measuring 20 inches in length—is not interrupted by an arteria transversa accessoria or Waldeyer's artery. It has super-

imposed on its periphery a series of minor arches. This monster arch jeopardizes the colonic peripheral circulation especially during surgical procedures on the transverse colon.

The jejunal artery is significant on account of its relation to gastro-duodenal dilatation during splanchnoptosia. **See section II., page ——.**

Second, as a common trunk with the arteria colica transversa. Hence the arteria colica dextra arises from a common trunk (almost equally with the colica transversa and ileo-colica) in 57 per cent of subjects and independently from the jejunal artery (or from the proximal mesenteric artery) in 43 per cent of subjects. It is probable that increased numbers of subjects might alter the above precentage since anatomic authors differ considerably.

Arteria Colica Dextra Arising Independently 43 Per Cent.

Fig. 25. In this subject the arteria colica dextra arises independently, separately. This specimen was dissected under alcohol and formalin, and drawn as a model by Zan D. Klopper. The arteria colica media I am naming the arteria colica transversa to accord with rational nomenclature. The arteria colica transversa emits the arteria pancreatico-duodenalis.

Arteria Colica Dextra Arising From a Common Trunk With the Arteria Ileo-Colica 20 Per Cent.

Fig. 30. In this subject the arteria colica dextra arises from a common trunk with the arteria ileo-colica. The specimen was drawn from my own dissection by Zan D. Klopper.

Arteria Colica Dextra Arising From a Common Trunk With the Arteria Colica Transversa 37 Per Cent.

Fig. 22. The specimen presents the arteria colica dextra arising from a common trunk with the arteria colica transversa. The words (in the cut) "colica dextra" should be written more proximalward near "colica transversa" (media). The specimen I dissected under alcohol and it was drawn from nature by Zan D. Klopper.

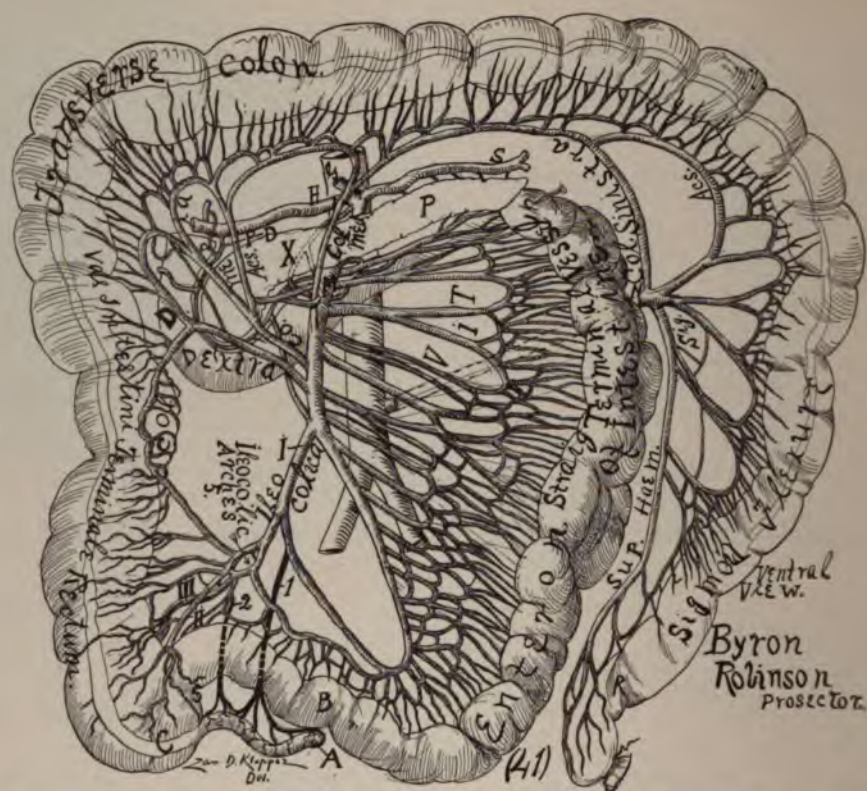
Finally in 65 consecutive subjects the right colic artery arose independently from the jejunal artery in 43 per cent. The right colic artery arose as a common trunk with the transverse colic artery in 37 per cent.

The right colic artery arose as a common artery with the ileo-colic artery in 20 per cent. Practically the right colic artery originates mainly (43 per cent,) from the middle of the jejunal artery between the ileo-colic and transverse colic arteries, at the level of the II. lumbar vertebrae, in the region of the origin of the distal mesenteric artery, some two inchs proximal to the aortic bifurcation, at the distal border of the duodenum. It arises from the dextra-ventral circumference of the jejunal artery. It emerges opposite the fifth ramus jejunalis.

Course. The right colic artery passes rightward toward the middle of the right colon dorsal to the peritoneum, on the dorsal abdominal wall and eventually enclosed between the blades of the right mesocolon, adjacent to the middle of the right colon. The right colic artery divides, bifurcates into a proximal and distal branch, one—the proximal branch—passing proximalward to inosculate with a similar vessel from the transverse colic artery and the other—the distal branch—passing distalward to inosculate with a similar vessel (the ramus colicus of the ileocolic artery) from the ileocolic artery.

The course of the right colic artery, though extremely variable, is mainly directed horizontal, or obliquely proximalward.

The right colic artery bifurcates and inosculates with other colic branches, forming maximum arches with their convexities directed toward the colon, From the convexities of these large arch emerge the "straight terminal ves-



ARTERIA APPENDICULARIS." "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL." "ILEAL ARTERY." "ENTEROCOLIC CIRCLE." "ILEAL ARTERY." AREAE ARTERIACAE TRUNCUS MESENTERICUS ARTERIOSUS PROXIMAL (ARTERIA JEJUNALIS).

Fig. 41. Specimen injected, dissected, and employed as a model by the artist Zan D. Klopper. Ventral view. A, appendix. B, ileum. C, cecum. M, proximal mesenteric artery. I, arteria ileocolica. II, areria ileocecalis dorsalis. III, arteria ileocecalis ventralis. N, distal mesenteric artery. VIT, vas intestini tenuis.

1, Arteria appendicularis (primary vessel), a vessel of medium dimension, arises from the "ileocolic circle" and supplies the main (free) portion of the appendix. 2, appendicular artery (secondary vessel), a vessel of limited dimensions arises from the arteria ileocecalis dorsalis and supplies the base of the appendix. The two appendicular arteries inosculate, forming a meso-appendicular arch. They emit 8 branches to the appendix. 5, is the anastomatic branch to the appendicular arteries.

The "ileocolic circle," partially duplicate, originates the main appendicular artery. The "circle" is of limited dimension on account of the distalward bifurcation of the trunk of the proximal mesenteric artery. Its function is to engorge its peripheral viscus.

The "ileocolic arches" numbering 5 are irregular in dimension, form and caliber of anastomosing branches. Their isolation, peculiar form, and limited collateral anastomosis suggests an independent blood apparatus for the cecum, however, a similar blood apparatus in fig. 41 may be observed in the flexura hepatica coli.

The "entero-colic circle" or Riolan-Haller arch is interrupted by a typical arteria transversa accessoria—a Waldeyer artery. This subject presents the 4 colic arteries, viz.: (1), ileocolica; (2), colica dextra; (3), colica transversa; (4), colica transversa accessoria (Waldeyer's artery). The Riolan-Haller arch is not only interrupted by a Waldeyer artery, but it has imposed on its periphery a series of minor vascular arches—all of which solidly and compactly fortifies the peripheral colonic circulation.

The "straight terminal vessel" is evident and on the right colon the mesocolic arch lies ventral to the colon; however, the "straight terminal vessel" is of ample length for ligature and clamp. Blunt dissection exposes the "straight vessel" with facility. The jejunal artery is significant on account of its mechanical arrangement with the duodenum.

See section II., page 13.

sel'' of the colon, which divide into two systems of parallel branches, viz., one—the dorsal—supplies the dorsal parietes of the colon and the other—the ventral—supplies the ventral parietes of the colon. Frequently the ventral system of ''straight terminal vessel'' of the colon possesses a ''long straight terminal vessel'' which not only nourishes the ventral coats of the colon but also the adjacent appendix epiploicus.

Dimension. The right colic artery is some 1/12 of an inch in diameter and 3 inches in length.

Distribution. The right colic artery distributes its branches to the right colon, and perchance to the coecum.

Right Distal ''Major Mesocolic Circle.''

The distalward directed terminal branch of the right colic artery inosculates with the ramus colicus (Ex arteria ileocolica) forming what I term, the *right distal ''major mesocolic circle''*—a constant structure with a constant location. The external or right lateral circumference of this right distal ''major mesocolic circle'' is of extreme interest in right colon resection or in right colon surgery, which has special relations to the ''straight terminal vessel'' of the right colon. The right circumference of the right distal ''major mesocolic circle'' may be located at some *distance* internal to the border of the right colon. See figures (22), (23), (28), (29), (30), (33), (35), (39), (42), (44), (50), (54), (55). It may be located in *contact* with internal border of the right colon, see figures (24), (25), (26), (31), (34), (36), (40), (45), (46). It may be located on the *ventral surface* of the right colon, see figures (32), (38), (41), (43), (47), (58), (62), (64). Whatever be the location of the right circumference of the right distal ''*mesocolic circle*'' with regard to the right colon—at some *distance*, in contact or on the ventral surface of the right colon—the ''straight terminal vessel'' is of ample length (½ to 2 inches) for ligation or clamp, without compromising the arc of the circle. The illustrations noted in relation with the right colon and distal right ''major mesocolic circle'' explains the conditions a thousand fold better than words or description.

The form and dimension of the right proximal ''major mesocolic circle'' vary within wide limits, while right distal ''major mesocolic circle,'' located in the distal right quadrant of the abdomen, presents limited variation. The ''circle'' may be divided by cross bar arteries.

Topography.

The topography of the right colic artery may be considered under four captions, viz.:

Holotopia. (Relation to general body).

The colica dextra is located unilaterally in the right distant quadrant of the trunk.

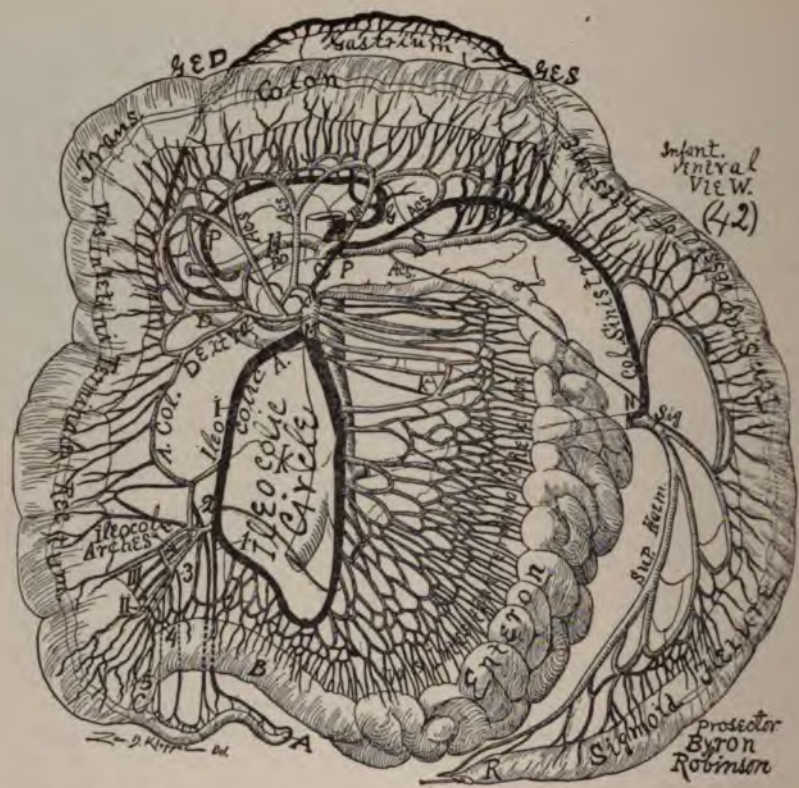
Skeletopia. (Relation to osseous system).

The right colic artery is on a level with the II. lumbar vertebrae. Its external lateral termination is practically midway between the twelfth rib and the iliac crest.

Syntopy. (Relation to adjacent viscera.)

The right colic artery is intimately associated with the dorsal peritoneum. It crosses ventral to vena cava, psoas muscle, ureter, spermatic or ovarian vessels. It may course ventral to the distal portion of the kidney.

It is associated with the middle of the right colon. The chief signification of the right colic artery is its relation to the middle of the right colon in regard to surgical procedures, especially in resection. However, the ''straight terminal vessel'' regardless of the location of the external lateral circumferences of the distal right ''major mesocolic circle'' is of ample length (1/2 to 2



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL." "ILEAL ARTERY." "CONCENTRIC GASTRIC CIRCLES." "ENTERO-COLIC CIRCLE." AREAE ARTERIACAE. "JEJUNAL ARTERY." "MAJOR MESOCOLIC CIRCLES."

Fig. 42. Specimen injected, dissected and employed as a model by the artist, Zan D. Klopper. Ventral view. A, appendix. B, ileum. C, cecum. M, proximal mesenteric artery. I., arteria ileocolica. II., arteria ileocecalis dorsalis. III., arteria ileocecalis ventralis. N, distal mesenteric artery. VIT, vas intestini tenuis.

1, Arteria appendicularis (primary vessel), a vessel of limited caliber arises from the right circumference of the "ileocolic circle" and supplies the free half of the appendix. 2, arteria appendicularis arises from the ileocolic arches and supplies the middle portion of the appendix. 3 and 4, arteria appendicularis, vessels of limited caliber, arise from the arteria ileocecalis ventralis and supplies the basal portion. The appendicular arteries (2 and 3) inosculate, forming a meso-appendicular arch—the four appendicular arteries emit 19 branches to the appendix.

The "ileocolic circle" of maximum dimension on account of the proximalward bifurcation of the proximal mesenteric trunk, is divided by arteries.

The "ileocolic circle," a typical "inosculation circle," consists of vascular arc, automatic peripheral ganglia and peripheral viscus. Its function is to engorge the peripheral viscus for physiologic purposes.

The "ileocolic" arches numbering 6 are irregular in dimension, form and caliber of anastomosing vessels. The "ileocolic arches" appear as an independent, isolated apparatus, however, fig. 42 presents a similar vascular apparatus at the flexura hepatic coli.

"Entero-colic" or Riolan-Haller arch is interrupted by an accessory artery and perhaps one might interpret the number of arteries in the flexura hepatica coli as indicating an accessory artery. At each colic flexure (ileocolic, hepatic, splenic and sigmoid) there is frequently an accumulation, an access of arches. In subject 42 there is a distinct accumulation of vascular arches "major mesocolic circles" of the four colonic flextures.

The jejunal—2 inches in length in this subject—is important on account of its relation to the duodenum in splanchnoptosia. For further description see section II., page 13.

inches) to ligate or clamp without compromising the integrity of the arch of the circle.

A significant matter may be mentioned in relation to the right colic artery, especially in relation to the distal right "major mesocolic circle." The ramus colicus (Ex arteria colica) not only inosculates with a similar branch of the colica dextra, forming the distal right "major mesocolic circle," but it originates the appendicular artery in 3 per cent. of subjects, which immortalizes the right distal "Major Mesocolic Circle."

Idiotopy. (Relation of component segments). The component parts of the right colic artery are continuous and form ½ of the circumference of the distal right "major mesocolic circle," the segments of which are, the right colic artery, the distal segment of the jejunal artery, the proximal segment of the ileocolic artery, the ramus colicus inosculating with the terminal branch of the right colic artery.

Branches. The right colic artery divides into two branches—the one, the proximal branch passes proximalward to inosculate with a similar branch from the colica transversa, forming the right proximal "major mesocolic circle"—the other, the distal branch, passes distalward to inosculate with a similar branch, (ramus colicus) from the ileocolic artery, forming the right distal "major mesocolic circle."

Conclusions in Regard to the Right Colic Artery.

The right colic artery varies in origin.

The right colic artery originates independently from the jejunal artery in 43 per cent. of subjects. It originates as common trunk with the transverse colic artery in 37 per cent. of subjects.

It originates as a common trunk with the arteria ileocolica in 20 per cent. of subjects.

The right colic artery aids to form distalward the right distal "major mesocolic circle"—a constant structure in a constant location, and proximalward the right proximal "major mesocolic circle"—a variable structure with variable location and form.

The "straight terminal vessel" of the right colic artery is of ample length (½ to 2 inches) for ligation or clamping during right colonic resection without compromising the "major mesocolic circles." Blunt dissection of the "straight vessel" is accomplished with facility. The right colic artery and the distal and proximal right "major mesocolic circle," which it aids to form are significant as regards surgical procedures on the right colon. The right colic artery possesses intimate relations with the duodenum, right kidney, right colon, ureter, ovarian or spermatic arteries, right psoas muscle, peritoneum.

III. TRANSVERSE COLIC ARTERY.

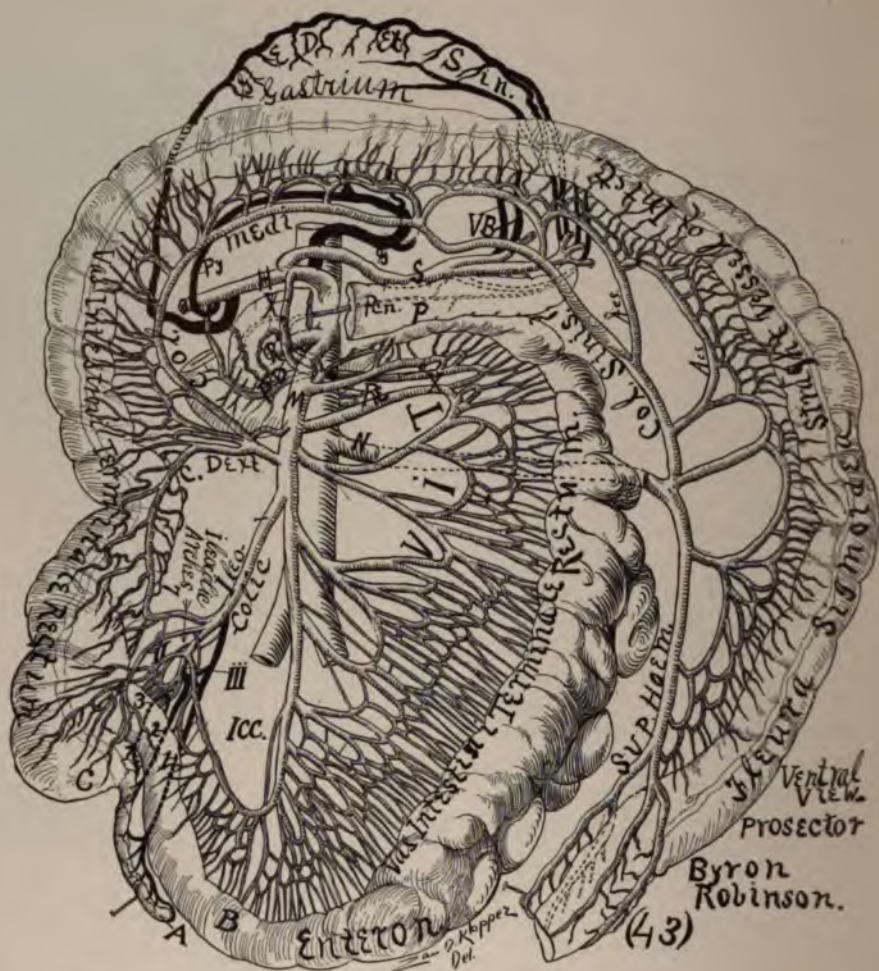
(Arteria Colica Transversa).

Incise the abdominal crucially, reflect the transverse colon proximalward, remove the distal transverse mesocolic blade whence the transversa colica artery will be exposed.

Synonyms. Arteria colica Transversa, Transverse colic artery, Middle colic artery, Arteria colica media, Mittlere Grimmdarm pulsader, Mittlere. Grimmdarm Schlagader. Colique moyenne. Colica dextra media, Right middle colic. Artere mesocolique, superior right colic artery.

Origin. The treansverse colic artery originates from the proximal end of the jejunal artery.

In 40 subjects the transverse colic artery arose independently or separately from the jejunal artery in 55 per cent. In 40 subjects the transverse colic



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL." "ILEAL ARTERY." "CONCENTRIC GASTRIC CIRCLES." "ENTERONIC CIRCLE." AREAE ARTERIACAE. "MAJOR MESOCOLIC CIRCLES."

Fig. 43. Specimen injected, dissected, and employed as a model by the artist, Dr. Zan D. Klopper. Ventral view. A, appendix. B, ileum. C, cecum. M, proximal mesenteric artery. I., arteria ileocolica. II., arteria ileocecalis dorsalis. III., arteria ileocecalis ventralis. N, distal mesenteric artery. VIT, vas intestini tenuis.

1, Arteria appendicularis (primary vessel), a vessel of moderate dimension, arises from the right circumference of the "ileocolic circle"—ICC—(i. e., from the ileocolic artery) and supplies ½ of the free end of the appendix. 2, arteria appendicularis—number 2 and 3, vessels of limited caliber—arises from the arteria ileocecalis dorsalis (i. e., from the ileocolic arches) and supplying the basal ½ of the appendix. The three appendicular arteries emit 13 branches to the appendix.

The "ileocolic circle" (ICC), of major dimension emits from its right circumference the chief appendicular artery. It is a typical "inosculation circle" the function of which is to engorge its peripheral viscus.

The "ileocolic arches" numbering 7 are irregular in form, dimension and in caliber of the anastomosing arteries. In subject 43 the "ileocolic arches" appear as quite an independent, isolated apparatus, however, accumulations of vascular archs appear in the remaining colonic flexures.

The "entero-colic circle" or great Riolan-Haller arch is not interrupted by an arteria

transversa accessoria or Waldeyer's artery. It is an arc of some 18 inches in length, however, the vascular integrity of the colon is enhanced by the series of vascular arches imposed on the circumference of the arcus transversus colicus.

The "concentric gastric circles" are reflected proximalward. The function of the "concentric gastric circles" is to congest the stomach for physiologic purposes.

Note space between distal ramus jejunalis and proximal ramus ilei.

Observe that the circumference of the right distal "major mesocolic circle" is resting on the ventral surface of the right colon, however, the "straight terminal vessel" is of ample length for ligature or clamp.

GENERAL REMARKS.

Note the marked division between the jejunal artery and the ileal artery. When the jejunal artery bifurcates it forms two primordially distinct arteries, viz.: (a), the ileal artery supplying the ileum (some 13 feet) and (b), the ileocolic artery supplying the cecum and appendix. Observe that some of the arches of the enteronic arteries are interrupted by cross arteries. In this subject the arteria renalis dextra (R) originates from the trunk of the proximal mesenteric artery. The arteria renalis sinistra (RE) possesses duplicity. Note the maximum length of the "vas intestini terminale rectum" in the enteron.

artery arose as a common trunk with the right colic artery in 45 per cent. of subjects.

The transverse colic artery though variable in origin it is less variable than the right colic artery.

Typical examples of the transverse colic artery arising *independently* or separately (55 per cent. of subjects from the jejunal artery, see figures (23), (25), (28), (33), (34), (35), (36), (37), (38), (41), (42), (43), (45), (64).

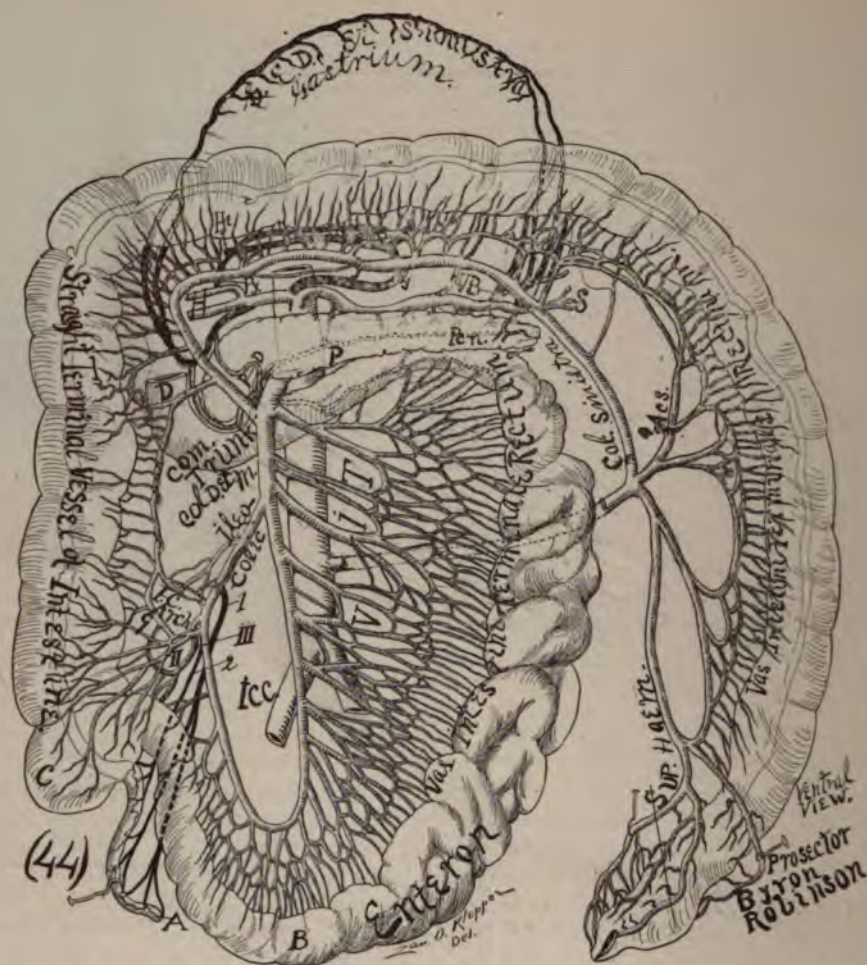
As typical examples of the transverse colic artery arising as a *common trunk* with the right colic artery (45 per cent. of subject), see figures (22), (26), (30), (32), (39), (40), (44), (46), (47), (50), (51), (52), (54), (55), (56), (57), (58), (59), (62).

Attention may be called to the view that in certain subjects the right colic and transverse colic arteries form a clustering or assemblage of strong arches adjacent to their immediate origins. It indicates a collection of vascular arches in flexura coli hepatica and flexura coli splenica, see figures (28), (30), (32), (36), (38), (41), (42), (43), (45), (46). The right colic artery and transverse colic artery may originate independently separately from the jejunal artery and immediately inosculate forming a series of consectuive arches, see figures (38), (42), (45).

The transverse colic artery arises from the jejunal artery between the distal border of the pancreas and the origin of the right colic artery. It originates if independent or separate from the right colic from the middle of the jejunal artery, opposite the 3rd, ramus jejunalis. If it originates from the common trunk with the irght colic artery it is located somewhat more distalward.

The origin of the transverse colic artery depends on its relations to the right colic and the accessory transverse colic artery (Waldeyer's artery). The transverse colic artery originates from the ventral circumference of the jejunal artery at the point where it enters the root of the mesenteron. Arteria colica transversa may arise from the arteria jejunalis, between the arteria colica dextra and the distal end of the arteria Pancreatico-duodenalis.

Course. The arteria colica transversa courses obliquely ventralward and rightward toward the transverse colon between the blades of the transverse mesocolon. It courses in a curved form through the mesocolon. In its final course it divides, bifurcates—one branch, the right, courses along the border of the right colon to inosculate with a corresponding branch from the right colic artery—forming what I term, the proximal Right "Major Mesocolic circle," the other, the left branch courses along the border of the left transverse colon to inosculate with a corresponding branch, from the distal mesenteric artery, forming what I term, the Left proximal "Major Mesocolic Circle," or the



APPENDICULAR ARTERY. "ILEOCOLIC CIRCLE." "VAS INTESTINI TERMINALE RECTUM." "CONCENTRIC GASTRIC CIRCLES." "ILLEOCOLIC ARCHES." "ILEAL ARTERY." "JEJUNAL ARTERY." "MAJOR MESOCOLIC CIRCLES." "ENTERO-COLIC CIRCLE."

Fig. 44. The specimen was injected, dissected and employed by the artist, Zan D. Klopper as a model. Ventral view. A, appendix. B, ileum. C, coecum (nonsymmetrical). I., arteria ileocolica. II., arteria ileocoecalis dorsalis. III., arteria ileocoecalis ventralis.

1, Arteria appendicularis (primary vessel), a vessel of limited dimension arises from the right circumference of the ileocolic circle (i. e., from the ileocolic artery) and supplies ¾ of the free portion of the appendix. 2, arteria appendicularis (secondary from the ileocolic artery) and supplies the basal portion of the appendix. The two appendicular arteries emit 12 branches to the appendix.

The "ileocolic circle" (ICC) of major dimension emits the entire appendicular circulation. Its function is to congest its peripheral viscus for physiologic purposes and to transport blood volume from the ileum to coecum and colon.

The "ileocolic arches" numbering 9 are irregular in form, dimension and calibre of anastomosing branches. They emit no appendicular artery and appear as quite as independent apparatus and isolated structure with limited lateral anastomosis.

The "ileal artery" begins at the point of emergence of the ileocolic artery. A distinct mark of division between the jejunal and ileal artery exists at the origin of the ileocolic artery or where the jejunal artery bifurcates.

The "concentric gastric circle" are in fig. 41 reflected proximalward. Observe that there

exists a powerful ramus hepaticus (He).. The function of the "gastric circles" is to engorge the stomach.

Enterocolic circle or monster Riolan-Haller arch—anastomotica magna—is not interrupted by any accessory artery (Waldeyer's artery). The arteria colica dextra serves as a common trunk for the arteria colica dextra and arteria colica transversa. It may be observed in fig. 44 that the arcus transversus mesocolicus has imposed on its proximal and lateral circumference a series of minor vascular arches which produces solid and compact peripheral circulation.

The jejunal artery in its clinical signification is evident in fig. 44. It is manifest that if the enteron passes more distalward, into the lesser pelvis as occurs in splanchnoptosia, the jejunal aortic angle will diminish and the transverse duodenum will become clamped firmer and firmer—ending in gastro-duodenal dilatation. From fixation the duodenum cannot pass distalward during the progress or splanchnoptosia. The jejunal artery and splanchnoptosia (with consequent gastro-duodenal dilatation) are inseparable.

General Remarks. The divisions and relations which I offer for the arteries of the tractus intestinalis will present new topographical views. It will simplify the complicated arteries supplying the enteron and offers a new base for the supply of appendicular from the "ileocolic circle" and "ileocolic arches." The division into the jejunal artery and ileal artery simplifies matters. The bifurcation of the jejunal artery into the ileocolic and ileal is constant. The ileocolic and ileal arteries are united inosculated at their proximal and their distal ends—forming the "ileocolic circle." The signification of jejunal artery is evident in clamping the transverse duodenum during splanchnoptosia). The jejunal artery supplies some 8 feet of enteron (the jejunum) with some six branches of maximum dimension transmitting a maximum volume of blood. The ileal artery supplying some 13 branches of enteron (the ileum) with some 13 branches of limited dimension and transporting a limited blood volume. By a study of the illustration No. (44) it will tell its own significant story. Five matters in (44) will bear study, viz.: (1), "concentric gastric circle;" (2), jejunal artery in relation to the duodenum; (3), "ileocolic circle;" (4) "ileocolic arches;" (5) "straight terminal vessel" in relation to intestinal resection.

Entero-colic circle," the Riolan-Haller arch. In a fatless transverse mesocolon the transverse colic artery is plainly visible in its entire course.

Dimensions. The transverse colic artery possesses a diameter of 1/10 of an inch in diameter, and a trunk length of 3 inches. It will transmit a larger volume of blood.

Branches. The transverse colic artery possess two branches, a right which inosculates with the proximal branch of the right colic artery and—a left branch which inosculates with a proximal branch of the arteria colica sinistra. In the bifurcation of the transverse colic artery an arch is frequently located, aiding to vascularize the space.

Topography.

The topography of the transverse colic artery may briefly be stated.

Holotopy. (relation to general body.) The transverse colic artery is located unpaired in the median portion of the trunk.

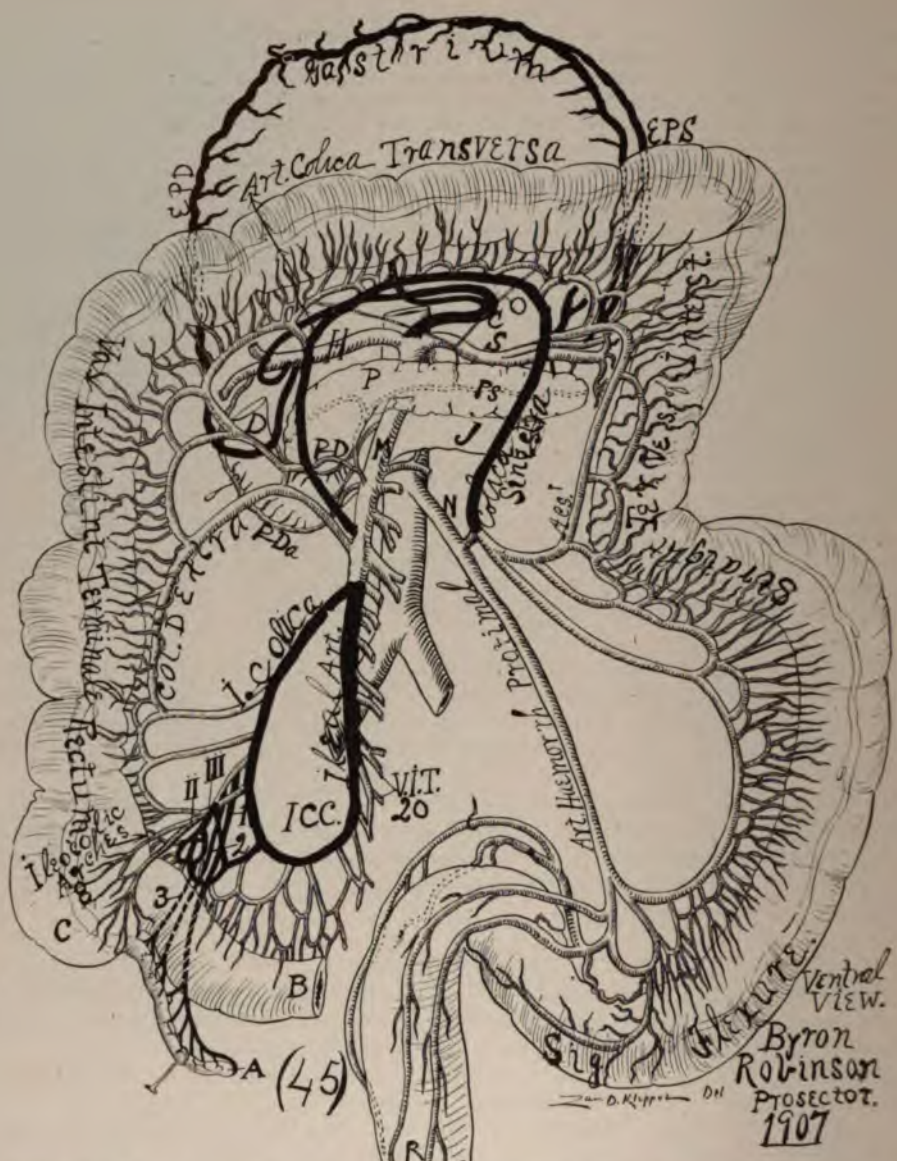
Skeletopy. (Relation to osseous system). The transverse colic artery is located on a level with the II. lumbar vertebra.

Syntopy. (relation to adjacent viscera). The transverse colic artery is intimately associated with the transverse colon, the transverse mesocolon, the "Entero-colic circle," (Arcus mesocolicus transversus, Riolan-Haller arch). The transverse colic artery is associated with the gastrium, pancreas, coils of enteron. The chief signification of the transverse colic artery is its share in forming the "Entero-colic circle" or arch and its vital relation to the colon physiologically and surgically. During surgical procedures the "Enterocolic circle" should not be ligated.

Idiotopy. (relation to component segments). The segments of the transverse colic artery consists of a trunk, leftward and rightward and a bifurcating branch.

Remarks on the Transverse Colic Artery.

The transverse colic artery *arises* closely adjacent to the origin of the arteria



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL." "ILEAL ARTERY." "CONCENTRIC GASTRIC CIRCLES." "ENTERONIC CIRCLE." AREAE ARTERIACAE JEJUNAL ARTERY. "MAJOR MESOCOLIC CIRCLES."

Fig. 45. Specimen injected, dissected, and employed as a model by the artist, Zan D. Klopper. Ventral view. A, appendix. B, ileum. C, cecum. M, proximal mesenteric artery. I., arteria ileocolica. II., arteria ileocecalis dorsalis. III., arteria ileocecalis ventralis. N, distal mesenteric artery. VIT, vas intestini tenuis.

1, Arteria appendicularis (primary vessel) and appendicular artery (secondary vessel) vessels of limited dimension arise from the "ileocolic arches" and supply the ¾ of the free portion of the appendix. 3, Appendicular artery (teriary vessel), a vessel of limited dimension arises from the arteria ileocecalis dorsalis (i. e., from the "ileocolic arches.") and supplies the base of the appendix. The whole appendicular supply is from the "ileocolic arches" (i. e., from the arteria ileocoecalis dorsalis et ventralis.)

The "ileocolic circle," a typical anostomotic circle, formed by the proximal and distal union of the ileal and ileocolic arteries escaped being the origin of the appendicular supply. The "ileocolic arches" are significant in Fig. 45 as they originate all the appendicular blood supply. They number 8 and are in nonuniform in dimension, form and caliber of the anastomosing vessels. The "ileocolic arches" appear as an independent apparatus and isolated structure, however, in No. (45) the lateral anastomosis is more extensive than usual. Note that the dorsal ileoccecal artery is considerably greater in dimension and number of branches than the ventral. In the "straight terminal vessel," observe on the left colon that the left proximal major mesocolic circle" rests on the ventral surface of the colon, however, the "straight terminal colic vessel" is of ample length (1 to 2 inches) to be clamped of ligated without ccmpromising the "major mesocolic circles." Blunt dissection frees the "straight terminal vessel" with facility.

The "ileal artery" emits 13 rami ilei to supply some 13 feet of ileum. It will be observed that the rami ilei at the distal ileum are of limited caliber furnishing limited blood volume hence disease of the distal ileum is frequent. The "enterocolic circle" possesses no accessory of Waldeyer's artery, but is interrupted by what I have termed the arteria pancreatica colica. In Fig. (45) two such arteries arise from the splenic (in other subjects mainly arise from the vessels in the pancreas). The "enterocolic circle" in subject (45) is of limited dimension on account of its peculiarity of construction and its integrity is preserved by the imposition on its circumference of a series of minor vascular arches.

The arteral fields "major mesocolic circles" in Fig. (45) are distinct for the right proximal and distal and left proximal.

The jejunal artery emits 5 rami jejunales of maximum dimension conducting a maximum volume of blood which acts not only as a prophylactic but a cure for disease. The relation of the jejunal artery to gastroduodenal dilatation is indelible.

General remarks. This subject presented a tendency to arterial multiplicity. Note the duplicate arches of the arteria colica sinistra. Observe that the ileocolic arches resemble those of the sigmoid.

pancreatico-duodenalis (distal) or the 3rd. ramus jejunalis. It arises between the distal border of the pancreas and the right colic artery. It *courses* obliquely rightward and ventralward between the transverse mesocolic blades to supply the transverse colon, bifurcating into right and left branches, which journey adjacent to the border of the transverse colon to inosculate with their corresponding fellows, from the right and left colic arteries. The significant matter in regard to the transverse colic artery is that it shares in the formation of what I term, the "entero-colic circle," arcus mesocolicus transversus, the Riolan-Haller arch. From the periphery of the "Entero-colic circle" branches ("Straight terminal vessel") are emitted to supply the transverse colon, which alone should be ligated or clamped during resection. The "Entero-colic circle" possesses the longest arch in the body (18 inches) except that of the "utero-ovarian circle" (20 inches). The transverse colic artery is practically the segment of the "Enteronic circle" which is utilized in medicine and surgery. Since the transverse colic artery shares and practically forms the "Enterocolic circle" the conclusions regarding the transverse colic artery will be identical with those of the "Entero-colic circle."

The rational therapeutics of the "Enteronic circle" is viscereal drainage which by stimulating its automatic specialized peripheral ganglia (Auerbach's and Billroth-Meissner's) maintains a maximum blood volume in the inosculation circle with maximum visceral elimination.

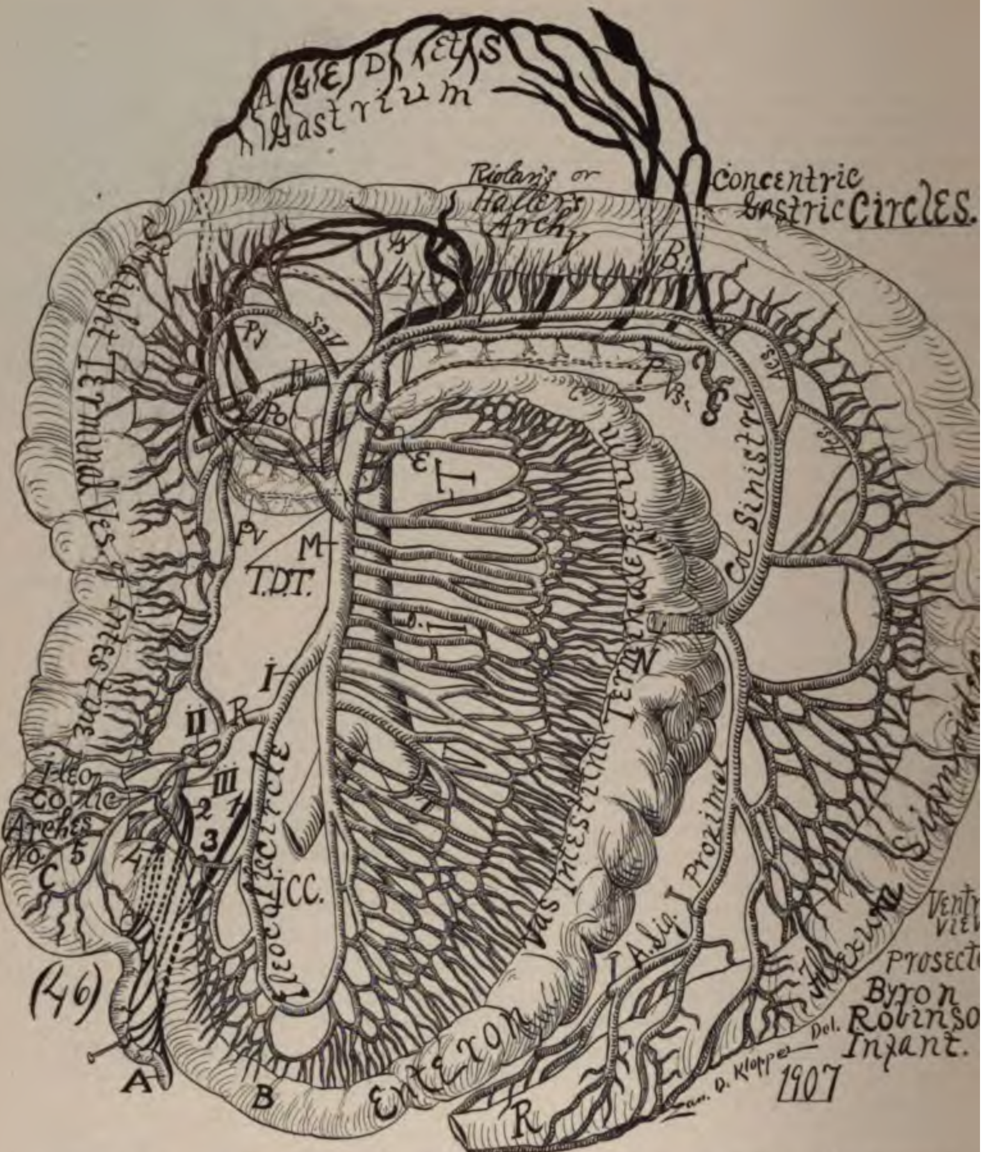
The natural stimulation of the automatic ganglia on the periphery of the inosculation circle is by food and fluid.

IV. ACCESSORY TRANSVERSE COLIC ARTERY.

Arteria Colica Transversa Accessoria.

(Waldeyer's Artery.)

During the dissection of some 65 subjects for the purpose of exposing and illustrating the arteries of the tractus intestinalis, I became interested in the accessory arteries of the transverse colon. An accessory artery of the transverse colon arises sufficiently frequent to demand a name.



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRICLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL." "ILEAL BATERY." "CONCENTRIC GASTRIC CIRCLES." "ENTERO-COLIC CIRCLE." "MAJOR MESOCOLIC CIRCLES." (AREAE ARTERIACAE) "JEJUNAL ARTERY."

Fig. 46. Specimen injected, dissected and employed as a model by the artist, Dr. Zan I Klopper. Ventral view. A, appendix. B, ileum. C, cecum. M, proximal mesenteric artery I, arteria ileocolica. II, arteria ileocecalis dorsalis. III, arteria ileocolis ventralis. N, dista mesenteric artery. VIT, vas intestini tenuis.

1, Arteria appendicularis (primary artery) a vessel of medium dimension arises from th "ileocolic circle" and supplies the free portion of the appendix. 2 and 4, appendicular arter (secondary or quartenary vessel) arises from the "ileocolic arches (i. e., from the dorsal a teria ileocecalis and 3 (tertiary vessel) arises from the "ileocolic arches" (i. e., the ventra arteria ileocecalis). 2, 3 and 4 supply the basal portion of the appendix. The appendicula arteries inosculate, forming arcs similar to the mesenteric arcs. The four appendicular a

teries emit 12 branches to the appendix. It is a well nourished appendix. The appendicular (see Fig. 46) arteries arise from the "ileocolic circle" and 'ileocolic arches."

The "ileocolic circle," a typical inosculation circle of relative limited dimension, produced by the proximal and distal inosculation of the ileocolic and ileal arteries originates the main appendicular artery. On the distal circumference of the "ileocolic circle" is imposed a series of minor vascular arches.

The "ileocolic arches" numbering 5 are irregular in form, dimension and in caliber of anastomosing vessels. The "ileocolic arches" originate 3 of the 4 appendicular arteries. The "ileocolic arches" appear as an isolated apparatus, an independent structure with limited lateral anastomosis and marked resemblance to the mesosigmoid arches.

The "ileal artery" emits 16 rami ilei to 13 feet of ileum. The caliber of the ileal branches progressively diminish toward the distal ileum is limitedly nourished, hence ulceration and perforation of the peripheral viscus may arise.

The "concentric gastric circles" are reflected proximalward in Fig. (46) and consist of an arc, automatic peripheral ganglia and peripheral viscus (stomach).

The "entero colic circle" is not interrupted by a Waldeyer artery. Besides, it is fortified by a series of minor vascular arches to a limited extent. The length of periphery in the "entero colic circle" endangers peripheral colonic circulation.

The "jejunal artery," of unusual dimension (length and diameter), emits 7 rami jejunales of maximum dimension conducting a maximum volume of blood to the jejunum acting as a prophylactice against disease and a cure for it. The "jejunal artery" courses perpendicularly over the ventral surface of the duodenum and clamps it firmer and firmer during the progress of splanchnoptosia. The mighty blood volume conducted to the jejunum accounts for the limited disease of the jejunum.

The "major mesocolic circles," the right proximal and distal are evident as well as the left proximal. The renal arterial fields are of practical worth.

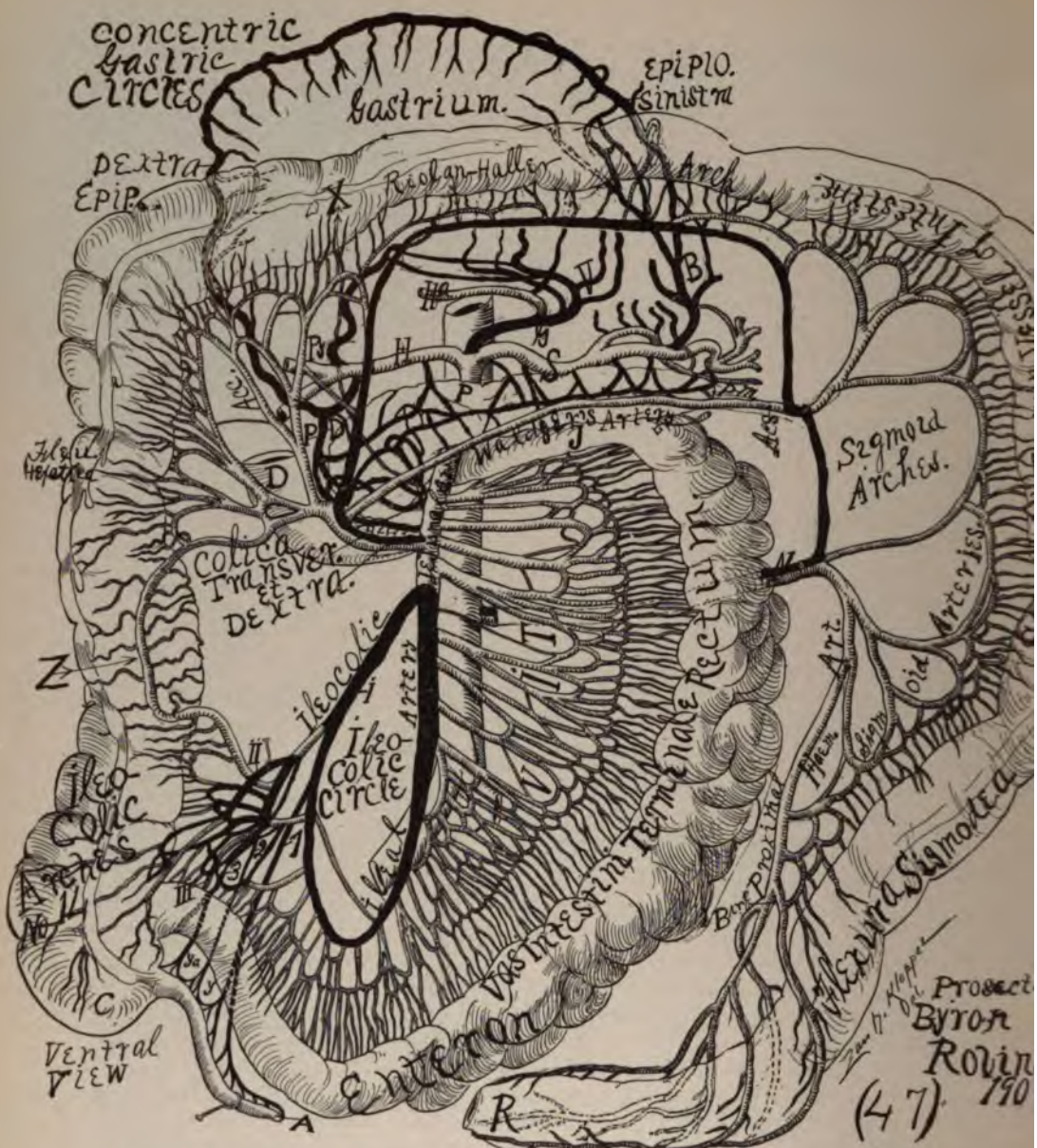
General remarks. A contrast may be observed (in Fig. (46)—) between the limited appendicular vascular supply and the abundant vascular supply to the sigmoid. A limited blood supply to any organ endangers its integrity. Clinical disasters continualy arise about the appendix with its limited blood supply, while they are rarely about the sigmoid with its abundant blood supply. The colica dextra and colica transversa arise from a common trunk. The trunk of the distal mesenteric artery bifurcates. Note the typical "straight terminal vessel."

The only literature, accessible to me, containing investigation on an arteria colica transversa accessoria is that from Prof. Waldeyer. I shall, therefore, eponymize this artery by calling it after the Prince of applied anatomy in Germany, "Waldeyer's Artery." (Wilhelm Waldeyer, German Anatomist, 1837—living Prof. in Berlin.)

I shall adopt the view that three regular colic arteries exist, viz.: Arteria ileo colica, arteria colica dextra and arteria colica transversa. If the transverse colon be reflected proximalward, frequently there may be observed an artery arising from the ventral or left wall of the jejunal artery (proximal mesenteric artery,) a short distance proximal to the origin of the arteria colica transversa. This artery courses through the middle of the transverse mesocolon to be be distributed to the middle of the transverse colon, through the mescolic arches. Whenever present, it presents in the anastomotica magna of Riolan and Haller; in fact, the momentous signification of the arteria colica tranversa accessoria is that it breaks, divides, the monster Riolan-Haller arch, rendering the circulation of the transverse colon more solid and compact. Besides, during surgical procedures, if present, it renders ulceration or gangrene less liable if the mesocolic arches become ligated. Waldeyer's artery multiplies the transverse mescolic arches, rendering more solid and compact the circulation of the colon transversum and thence during surgical procedures there is less liability of depriving blood, by clamp or ligature, from terminal areas sufficiently to produce ulceration or gangrene.

From the accompanying illustrations it is amply evident that the surgeon should ligate or clamp in intestinal surgery, what I term the "straight terminal vessel" of the intestine only and not molest the mesocolic arches, if the avoidance of ulceration or gangrene is to be expected.

First. I will present one illustration of three typical colic arteries, viz.:



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL." "JEJUNAL ARTERY." "ILEAL ARTERY." 'CONCENTRIC GASTRIC CIRCLES." "ENTERO-COLIC CIRCLE." "MAJOR MESOCOLIC CIRCLES." (AREAE ARTERIACAE.)

Fig. (47). Specimen injected, dissected, and employed as a model by the artist, Zan D. Klopper. Ventral view. A., appendix. B, ileum. C. cecum. M, proximal mesenteric artery. I., arteria ileocolica. II., arteria ileocecalis dorsalis. III., arteria ileocecalis ventralis. N, distal mesenteric artery. VIT, vas intestini tenuis.

3, Arteria appendicularis (primary vessel) a vessel of limited dimension, arises from the "ileocolic circle" (i. e., from the ileocolic artery) and supplies the free portion of the appendix. 2 and 1, appendicular arteries, vessels of limited caliber, arises from the ileocolic arches (i. e., from the arteria ileocolis dorsalis). The appendicular arteries inosculate to

produce meso-appendicular arcs. The three appendicular arteries emit 18 branches to the appendix.

The 'ileocolic circle," a typical "inosculation circle" formed by the proximal and distal anastomosis of the ileocolic and ileal arteries is of marked dimension and originates the chief appendicular artery. The ileocolic circle has imposed on its periphery a series of minor vascular arches. It is divided by a cross artery. Its function is to congest its peripheral viscus.

The "ileocolic arches" numbering 14 are irregular in dimension, form, and in the caliber of anastomosing vessels. The "ileocolic arches" appear as an isolated apparatus, an independent structure with limited lateral anastomosis and marked resemblance to the meso-sigmoid arches. The "ileocolic arches" originate two appendicular arteries.

As regards the "straight terminal vessel" note the right colic loop i. e., the external circumference of the right distal "major mesocolic circle lying on the ventral surface of the right colon, however, blunt dissection will free with facility the "straight terminal vessel" with ample length for clamping or ligating.

The "ileal artery" beginning at the emergence of the ileocolic emits 19 rami ilei of constantly diminishing caliber toward the cecum. The rami ilei at the distal end of the ileum as usual is extremely limited in caliber. Hence the disease, ulceration and perforation occur in the ileum.

The "concentric gastric circles" (in black) are reflected proximalward. Note that there is a ramus hepaticus (Ha), of considerable dimension. hence, in ligation of the gastric artery at the left end this branch must be reckoned.

The "entero-colic circle" or the monster Riolan-Haller arch is interrupted by an accessory transverse artery (ACS) or a Waldeyer artery, and fortified in the peripheral colonic circulation by a series of minor vascular arches imposed on its circumference. Multiple arches enhance and fortifies peripheral circulation.

The "major mesocolic circles" (arterial fields) are definite in fig. (47).

The "jejunal artery" (identical with trunk of the proximal mesenteric artery), emits 5 rami jejunales of maximum caliber transmitting large volumes of blood to the jejunum—8 feet. The maximum blood supply to the jejunum maximizes digestion and minimizes disease. The jejunal artery averages 3 inches in length. It is significant in gastro-duodenal dilatation.

General remarks. The limited blood supply of the appendix is in direct contrast to the abundant blood supply to the sigmoid. Clinical disasters are also in direct contrast. The vessel emitted from the right side of the ileal artery serves as common trifurcation trunk of the colica dextra colica transversa and colica transversa accessoria. Note the accumulation of vascular arches in the flexures of the intestinal tract (ileocolic angle) flexura splenica, flexura sigmoidea.

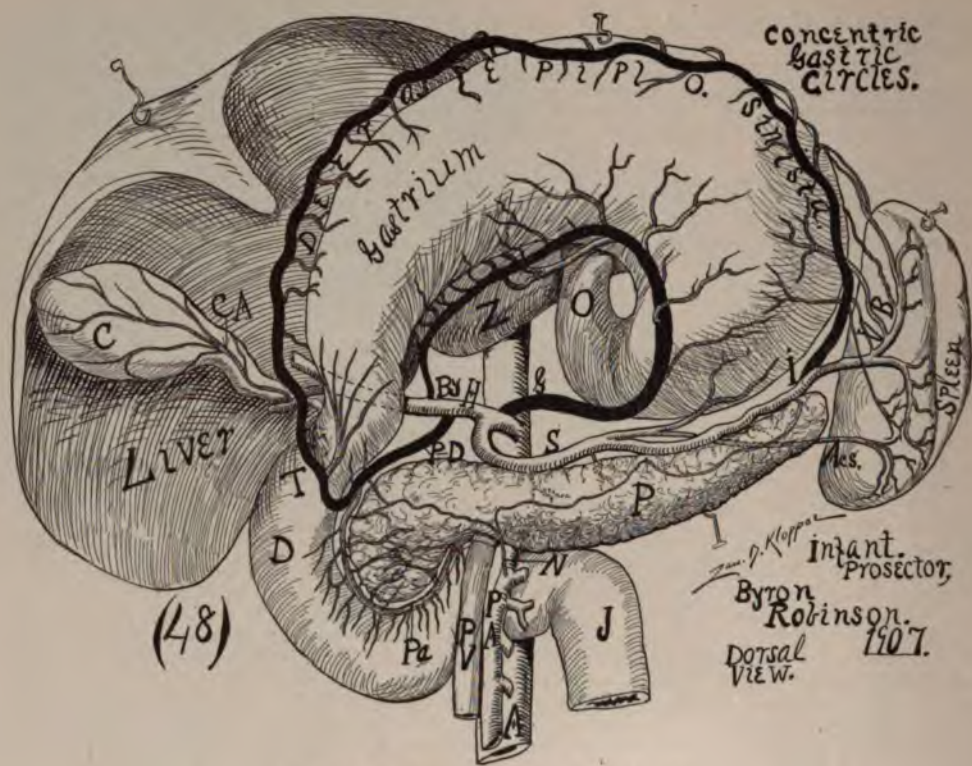
ileocolic, colica dextra and colica transverse (see figure 26). This normal type requires no comment.

Second. I will present illustrations of two typical forms of arteria colica transversa accessoria or Waldeyer's artery (see figures 41, 58.)

Figure 41 presents the three typical colic arteries (ileocolica, colica dextra and colica transversa). However, a short distance proximal to the origin of the colica transversa in the region of the root of the fourth or fifth ramus jejunalis emerges a fourth colic artery from the ventral surface of the jejunal artery on proximal mesenteric artery. (In the illustration it is erroneously marked "col. med.") This is Waldeyer's artery, or arteria colica accessoria transversa. It is a typical illustration. The significance of Waldeyer's artery in the illustration is evident. It is an interpolating artery. It breaks or divides the Riolan-Haller's extensive arch—one of the most extensive inosculations in the body—the anastomotica magna. In some bodies the arcus transversa colica will measure 18 inches—a long, dangerous arch. Observe that in all the bifurcating transverse mesocolic arches, the space in the bifurcation is occupied or bridged by a secondary arch.

Fig. 58 is also a typical form of an accessory or fourth colic artery. It arises from the left circumference of the proximal end of the jejunal artery or proximal mesenteric artery. This illustration presents the tendency to multiple colic arteries, simulating the multiple enteronic arteries with consequent multiple arches. (However, this subject tended exceptionally to multiplicity of both colic and enteronic arteries.)

Third. I will present two typical transitional forms, i. e., a tendency to form a fourth colic artery (see figures 27, 28).



"CONCENTRIC GASTRIC CIRCLES."

Fig. 48. The "concentric gastric circles (in black) reflected.
Drawn from my personal dissection.

The "concentric gastric circles." Presents the dorsal view of the two "concentric gastric circles" (in black). The gastro-hepatic circle, the leser of the two concentric circles, is formed by the anastomosis of the gastric and hepatic artery, and the circle is completed by the hepatic branch. This circle is located along the lesser gastric curvature. The gastro-splenic circle, the greater of the two "concentric gastric circles" lying along the greater gastric curvature. The gastro-splenic circle, the greater of the two "concentric gastric circles" lying along the greater gastric curvature, is formed by the anastomosis of the gastro-epiploica sinistra and dextra with hepatic and splenic branches. O, esophagus. In this subject the celiac avis is inclined toward the right; N is a branch arising from the proximal mesenteron and anastomoses with the pancreatico-duodenalis and splenic; T is the pylorus; PV and PA is vasa mesenterica proximal; F, jejunum. Observe the duodenum clamped between the aorta abdominalis and arteria mesenterica proximal, which frequently produces gastro-duodenal dilatation. Note the plan of the bloodvessel to the stomach, viz., (a) trunk (celiac axis); (l) arch (concentric gastric circles); (c) straight terminal vessels of the stomach (the vessels emerging from the concentric gastric circles.

The gastric circles consist anatomatically of an arc, automatic peripheral ganglia and peripheral viscus. Physiologically the function of the gastric circle is to engorge the stomach.

The gastric circle is functionated by stimulation of its automatic peripheral ganglia (Auerbach's and Billroth-Meissner's) which dilate its vessels irrigating and engorging the stomach with extra blood.

Blood volume is required for digestion (to initiate sensation. secretion, absorption, peristalsis).

In figure 27, from the dimension of the vessel, I have considered the arteria colica dextra and transversa as arising from a common trunk, which is joined to the arteria colica transversa accessoria by a connecting branch of large dimension. Waldeyer's artery assumes a course through the middle of the mesocolon transversum, and the space of its bifurcating arch with the arteria

mesenteric distal is occupied by one major and several minor or secondary mesocolic arches.

In figure 28 additional transitional forms may be observed, with the tendency toward multiplicity of transverse colic arteries.

It is amply evident that the method or plan assumed by the accessory transverse colic arteries is to divide the "Entero-colic circle" or Riolan-Haller's extended arch. Extensive vascular arches tend toward danger in the nourishment of adjacent tissue; collateral circulation is at a minimum.

Doubtless, anatomists have heretofore considered the arteria colica transversa accessoria as an arteria sinistra proximal or a duplicity of the arteria colica transversa. This appears evident from the "variations or anomalies of arteries" by Krause and Henle. We believe from 65 consecutive dissections that the frequent occurrence of an arteria colica transversa accessoria is sufficient evidence to add this artery by name to the anatomic list; also, the recent rapid rise and progress of intestinal surgery demands an exact nomenclature for accurate and safe surgical procedures.

It appears to me that no arteries vary more than those of the transverse colon, hence, any views which simplify the anatomy and add certitude to surgical procedures are to be welcomed.

I regret that deficient material from the Primates—orang, chimpanzee, gorilla—has not permitted me to form opinions as to the arteria colica transversa accessoria for comparison in man.

The recognition of a fourth colic artery, ileo colica, colica dextra, colica transversa and colica transversa accessoria, will enable anatomists to continue the nomina anatomica, Basel (B. N. A.) by the addition of a similar proper term. It will insure more exact anatomy and more certitude in surgery which is particularly required in resection, circular colorrhaphy and lateral anastomosis.

(a) THE "ILEOCOLIC CIRCLE."

During the dissection of some 65 consecutive subjects I made the observation that there is one constant mesenteric arch, or rather one constant mesenteric circle, viz: which I shall term the "*Ileo-colic circle.*" The "ileo-colic circle" is formed by the bifurcation of the jejunal artery into the ileocolic artery and ileal artery and completed by their distal inosculation. In other words, the jejunal artery divides into the ileo colic and ileal arteries which reunite some 5 inches distalward forming constant mesenteric vascular circle—a constant fixed primordial circular vascular landmark. The ileocolic circle is located constantly in the ileocolic angle and is a constant structure. It may be accompanied by mesenteric apertures, from insufficient vascular nourishment, which may serve for hernial strangulation. The "ileocolic circle" is frequently divided into compartments by arteries of varied dimensions which are destined to nourish the mesentery within the circle or are bifurcated loop branches of the main circle. The clinical significance of the "ileocolic circle" is that its right circumference 96% (i. e., the ileocolic artery) is the main source, or the origin of the arteria appendicularis which alone will immortalize it. The "ileocolic circle" existing in the form of an oval, measures practically 2x6 inches. The dimension of the "ileocolic circle" depends upon the location of the bifurcation of the jejunal artery and the length of the ileal artery. The jejunal artery may bifurcate proximal, on a level or distal to the origin of the distal mesenteric artery i. e., in the region of the III lumbar vertebra.

The "ileocolic circle" may possess, imposed on its periphery a series of minor vascular arches. The "ileocolic circle" is a primordial vascular landmark destined to nourish the ileum and cecum (with appendix as an ancient stomach). The "ileocolic circle" is associated and in relation with the right

"CONCENTRIC GASTRIC CIRCLES."

Fig. 49. Liver reflected. Drawn from my personal dissection.

The "concentric gastric circles." Presents the ventral view of the two "concentric gastric circles" (in black). The gastric artery arising from the celiac axis and ending in the hepatic at PY is the gastro-hepatic circle, the smaller of the two concentric gastric circles located along the lesser gastric curvature. H marks the arteria hepatica, which completes the gastro-hepatic circle. The gastro-epiploica dextra anastomoses with the gastro-epiploica sinistra, and the gastro-splenic circle is completed by the hepatic and splenic branches,(and is the greater of the two concentric gastric circles, located along the greater gastric curvature. Observe the plan of the circulation is: (q) trunk (celiac axis); (2) gastric arch (the concentric gastric circles"); (3) the "straight terminal vessel" of the stomach (the vessels emerging from the concentric circles.)

The gastric circle consists of a vascular arc, automatic peripheral ganglia and peripheral viscus. The function of the gastric circle is to engorge its peripheral viscus (the stomach).

The gastric circle is functionated by stimulation of its automatic peripheral ganglia (Auerbach's and Billroth-Meissner's) which dilates its vessels, irrigating, engorging the stomach with extra blood for physiologic purposes. The natural stimuli of the automatic gastric ganglia are fluid and food.

psoas, distal ileum, cecum, right ovary, right oviduct, ureter, common iliac and the treacherous, dangerous appendix to which it primarily chiefly and directly emits the vascular supply. It is directly associated with the "ileocolic arches." By placing the mesentery on leftward tension one may view plainly the "ileocolic circle" though noninjected.

The "ileal artery" extends from the distal end of the jejunel artery to its distal anastomosis with its opposite fellow, the ileocolic artery. The "Ileal artery" forms the left circumference and the ileocolic artery forms the right circumference of the "ileocolic circle." The ileal artery emits branches (a dozen and a quarter) to nourish the ileum of such limited caliber (as compared

with the jejunal artery—possessing a half dozen maximum branches) with consequent limited blood volume, especially at the distant illeum that it is subject to ulceration and perforation (in typhoid fever and tuberculosis). Blood volume cures and is a prophylactic against disease. Hence the jejunum with its maximum calibered branches (rami jejunales) and consequent maximum blood volume is not only the chief digestive segment of the tractus intestinalis, but is rarely subject to disease (ulceration or perforation). The emergence of the ileocolic artery is the point of division between the jejunal artery and ileal artery. The ileocolic artery is destined to nourish the coecum and appendix. The ileal artery is destined to nourish the ileum.

The "ileocolic circle," one of the constant mesenteric arches, is located practically in the ileocolic angle. It is a circle of considerable dimension (2x6 inches), resembling the proximal and distal "gastric circles." It is marked by less dimension than the utero-ovarian vascular circle, however, grater than that of Willis. The "ileocolic circle" will, in its due time become dignified into a recognized vascular circle like that of the philosophic Willis, which has held undisputed sway for 250 years. However, one fact will immortalize the "ilecocolic circle," and that is in the majority of subjects (96 %) the appendicular artery arises from its right circumference. The "ileocolic circle" is an important landmark, for consideration, anatomic physiologic, pathologic.

The "Ileocolic circle" will serve as an anatomic vascular landmark. It will simplify the vascular anatomy in the ileocolic region. Its right circumference the ileocolic artery—the origin of which will mark the division between the jejunal and ileal arteries, and hence indicate the jejunal and ileal segment of the enteron.

By the aid of the "ileocolic circle" the anatomist can unfold with greater practicality the vascular rélations of the ileum and coecum, but especially that of the appendix.

The "Ilecocolic circle" is an important practical physiologic vascular landmark. The great crux, the central rock and base of circulation is anastomosis which is here indicated in its typical form—that of a circle; collateral anastomosis is complete, perfect. Our chief means to control the blood current for therapeutic purposes is through the "inosculating circle" e. g. the utero-ovarian circle.

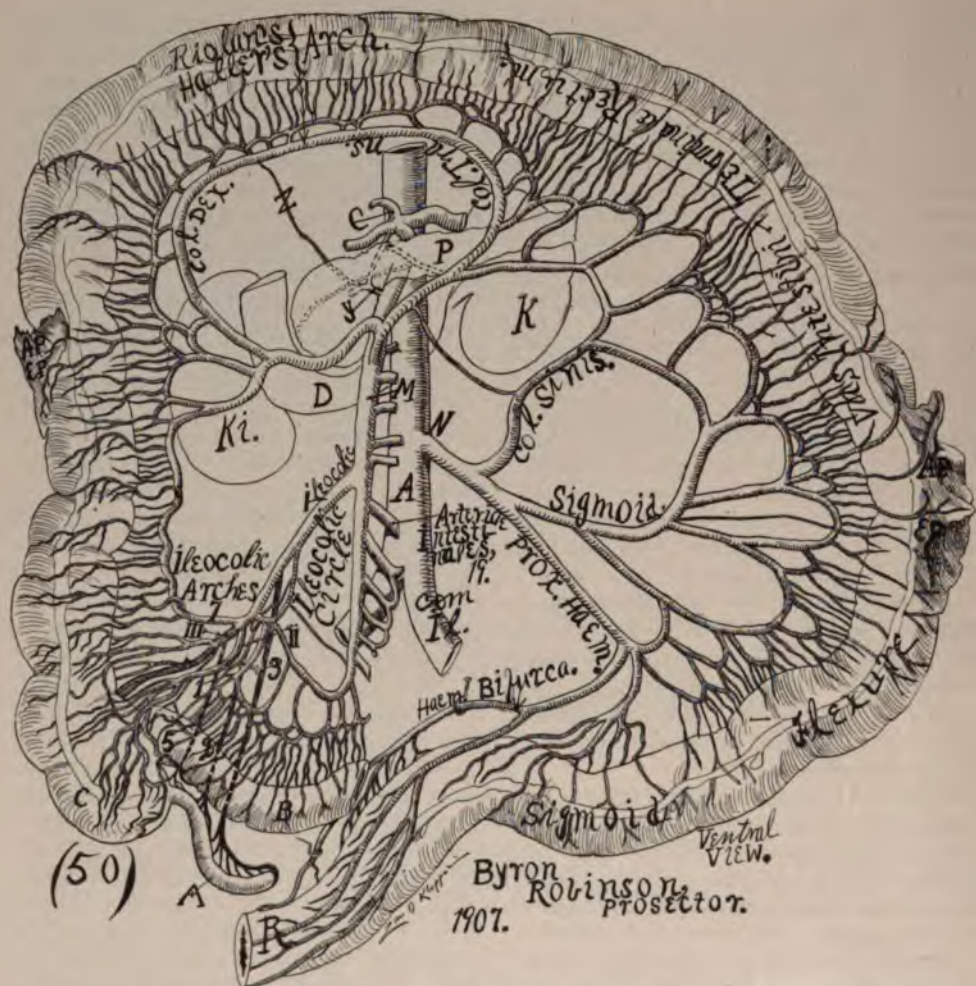
Physiologically the "ileocolic circle" is supplied with such numerous radiating branches of marked dimensions that if it were ligated ample collateral circulation would perserve tissue, nutrition and furnish sufficient blood volume for function of the tractus intestinalis (sensation, absorption, secretion, peristalsis).

The "Ileocolic circle" presents practical pathologic conditions. Apertures of the peritoneum within the "ileocolic circle" may produce (atrophic) peritoneal apertures from lack of blood supply, sufficient to allow intestinal coils to become strangulated.

Arterial sclerosis of the "ileocolic circle" may occur to sufficient degree to interfere with nutrition of tissue and Entero-colonic function (sensation, absorption, peristalis, secretion), particularly that of the appendix. Should an embolus appear in any segment of the "ileocolic circle" the collateral circulation is sufficiently abundant to preserve tissue and function and re-establish collateral circulation with facility.

The "ileocolic circle" is one of the most important vascular landmarks especially in relation to the dangerous and treacherous appendix—dangerous because perityphlitis kills, and treacherous because its capricious cause cannot be prognosed.

I find no reference in literature to the "ielocolic Circle." It is a result of my personal original investigations. I launch it in the professional current to



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSELS." "ILEAL ARTERY." "ENTERO-COLIC CIRCLE." AREAE ARTERIACAE. "ARTERIA JEJUNALIS." "MAJOR MESOCOLIC CIRCLES."

Fig. (50). Specimen injected, distended, and employed as a model by the artist, Dr. Zan D. Klopper. Dorsal View. A, appendix. B, ileum. C, cecum. M, proximal mesenteric artery. I, arteria ileocolica. II, arteria ileocecalis dorsalis. III, arteria ileococalis ventralis. N, distal mesenteric artery.

2 and 3, appendicular arteries (primary and secondary vessels) vessels of medium dimension, arises from the "ileocolic circle" (i. e., from the ileocolic artery) and supplies the free portion of the appendix. 1, appendicular artery (tertiary vessel), a vessel of diminutive caliber arises from the ileocolic arches (i. e., from the dorsal ileocecalis). The appendicular arteries inosculate to form meso-appendicular arcs. The three appendicular arteries emit 14 branches to the appendix. 5, inosculation branches between coecum and appendix.

The "ileocolic circle" in subject (50) was markedly limited in dimension. It has imposed on its distal periphery a series of minor vascular arcs or loops. The "ileocolic originates the main appendicular artery. It is divided into compartments by cross arteries. Its function is to congest its peripheral viscus (ileum, appendix, coecum).

The "ileocolic arches" numbering 7 are irregular in form, dimension and in caliber of anastomosing arteries. The ileocolic arches are not strikingly prominent as independent structures or isolated apparatus as in many other subjects, however, they markedly resemble the sigmoid arches.

Observe the "long straight terminal vessel" and the "short straight terminal vessel" in the "straight terminal vessel" of the colon.

"Enteronic circle or the Riolan-Haller arch is of limited dimensions being fortified by multiple minor vascular arches which consolidate and make compact their peripheral circulation.

Ki, K, the kidneys occupy the duodeno-renal and the renal arterial field—"major mesocolic circles" of practical value.

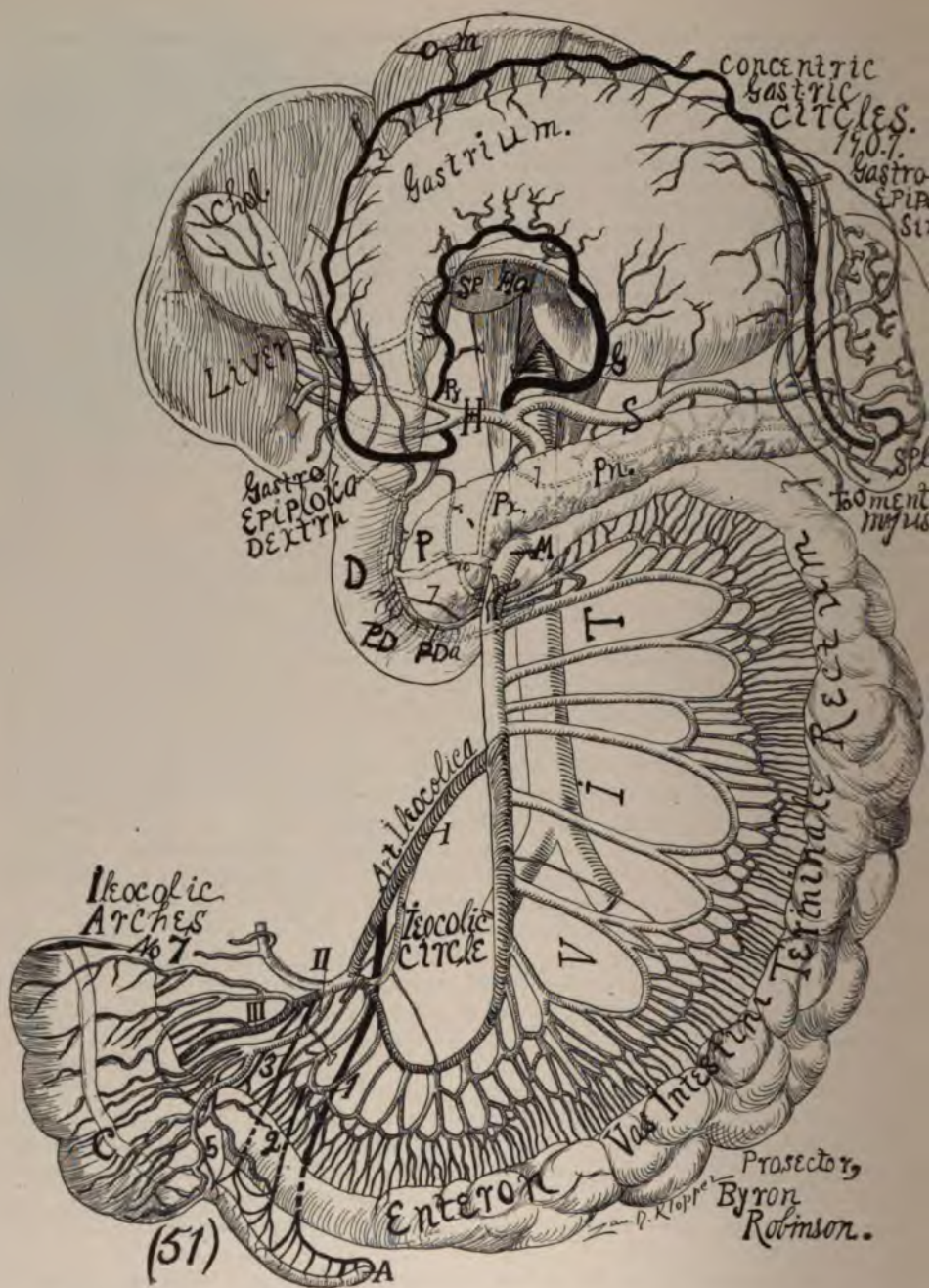
The "jejunal artery" extending from its origin in the aorta dorsal to the pancreas to the emergence of the ileocolic artery is of unusual length emitting 5 rami jejunales in a horizontal direction to supply with a rich volume of blood the jejunum. The jejunal artery is indelibly associated with the gastro-duodenal dilatation during the progress of splanchnoptosia.

General remarks. The distal mesenteric artery is rich in minor vascular arches, solidifying and fortifying peripheral circulation. Z, arteria pancreatica colica. Note the abundant blood supply to the cecum (in contrast to that of the appendix).

begin its endless journey. I predict that it will withstand the uncertain vicisitudes of fortune equally well with the circle of Willis and be of more practical value to mankind. Utility is the standard of value.

The control of blood volume to definite localities is doubtless the most important and practicable agent in therapeutics. It rests on the axiom that *blood cures disease.* This is not new, neither did Bier discover it. He introduced successful systematic practical application of congestion curing disease. For 50 years gyneologists have made practical application of congestion curing disease. For example, the utero-ovarian artery, the genital vascular circle (Circle of Byron Robinson) is the typical *vascular circle* where blood current and blood volume can be maintained and controlled for therapeutic purposes. If the genital ganglia (pelvic brain, hypogastric plexus etc.) be stimulated the utero-ovarian artery (genital vascular circle) along which the automatic genital ganglia are located becomes dilated and the blood volume in the artery becomes increased, the genitals become congested and many forms of genital disease cured (especially the inflamatory kinds) myometritis, pelvic peritoneal exudates. The stimulus to the genital ganglia and consequent marked dilation of the utero-ovarian artery may be (1) heat (vaginal douche), (2) hygroscopy (boroglyceridetampon), (3) electricity (irritation), (4) stempessary (irritation), (5) massage (irritation), (6) gestation (irritation), (6) copulation (irritation), cathartics, diuretics (Stimulation to adjacent visceral tracts congests the tractus genatalis (utero-ovarian artery). The utero-ovarian artery, the genital vascular circle, is the one vascular circle, (however, to application accessible) in which by controlling its blood volume, extensive, solid reliable advances have been established in curing genital disease. Controlling blood volume is the most rational agent of therapeutics. It may be hoped that the day is not far distant when we can control the blood current and volume in the "ileocolic circle" to cure disease—especially perityphlitis. The successful accomplishment of control of blood current and volume in the "ileocolic circle" will be equal to the established control of the blood current and volume in the "utero-ovarian circle." The control of blood current and volume in the "ileocolic circle" would aid in curing some prevalent diseases viz: (a) perityphlitis, (b) Meso-appendicular, adhesions, (c) ileal disease, (tuberculosis, typhoid ulceration.)

Practically the cause of the majority of cases of perityphlitis is trauma of the psoas muscle, inducing germs or their products to migrate through appendicular muscosa, muscularis and serosa causing periappendicular peritoneal adhesions, mesoperityphlitis, which compromise the appendicular blood vessels and flex the appendix checking appendicular drainage. If the blood current and volume of the "ileocolic circle" could be controlled, concentrated, increased by therapeutics the meso-appendicular adhesions would absorb, dissolve whence the compromised meso-appendicular vessels would be released and flexed appendix would enjoy ample drainage.



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL." "ILEAL ARTERY." "CONCENTRIC GASTRIC CIRCLES." "ENTERO-COLIC CIRCLE." JEJUNAL ARTERY.

Fig. (51). Specimen injected, dissected and employed as a model by the artist, Dr. Z D. Klopper. Ventral view. A, appendix. B, ileum. C, cecum jejunal or proximal m enteric artery. I., arteria ileocolica. II., arteria ileocecalis dorsalis. III., arteria ileocec

ventralis. N, distal mesenteric artery. I., arteria ileocolica. II., arteria ileocecalis dorsalis. III., arteria ileocecalis ventralis. N, distal mesenteric artery. VIT, vas intestini tenuis.

1 and 2, Appendicular tery (primary and secondary vessels) vessels of moderate length and limited calibers arise from the "ileocolic circle" (or imposed minor vascular arch), and supplies the free portion of the appendix. 3, appendicular artery (tertiary vessel), a vessel of diminutive caliber arises from the ilocolic arches (i. e., the dorsal ileocecalis) and supplies the basal portion of the appendix. The 3 appendicular arteries emit 14 branches to the appendix. The appendicular arteries inosculate producing meso-appendicular arcs, resembling the mesenteronic arcs.

The "ileocolic circle,' of usual dimension, formed by the ileocolic artery on the right circumference and the ileal on the left circumference originates 2 of the 3 appendicular arteries. Its object is to congest its peripheral viscus (ileum, appendix and colon).

The "ileocolic arches," numbering 7 are irregular in form, dimension and the caliber of the anastomosing vessels, however, they resemble the mesosigmoid arches. III., arteria ileocecalis dorsalis. II., arteria ileocecalis ventralis.

The "straight terminal vessel" is plainly evident in the enteron and a smilar apparatus may be observed in the gastrium (reflected proximalward).

The "concentric gastric circles" reflected proximalward and in black) are here beautifully demonstrated. The ramus hepaticus is present inosculating with the hepatic artery. Ligation of the gastric artery should be cautiously performed in such subjects. "Arteria jejunalis," extending from its origin in the aorta dorsal to the pancreas to the mergence of the ileocolic artery emits 5 rami jejunalis of maximum caliber conducting a maximum volume of blood to promote vigorous digestion, as a prophylactic and cure of jejunal disease.

General remarks. The illustration was drawn on a large scale. The vessels well separated in order to expose the numerous vessels and arches. The factors to note in Fig. (51) are: (1), "straight terminal vessel;" (2), appendicular vessels; (3) 'ileocolic arches; (4), "ileocolic circle." (5), "concentric gastric circles."

The "inosculation circle" is here evident, consisting of: (a), vascular arc; (b), automatic, specialized, peripheral ganglia; (c) peripheral viscus.

The function of the "inosculation circle" is to engorge the peripheral viscus for physiologic purposes.

The functionation of the "inosculation circle" is influenced by the stimulation of the automatic peripheral ganglia which dilates its vessels irrigating the peripheral viscus with extra blood, engorging it.

The nerve ganglia associated with the periphery of the "ileocolic circle" are those of Auerbach, with Billroth-Meissner and the stimulation of these automatic ganglia (with consequent congestion) may be accomplished by numerous agents viz: (a) heat, (b) massage, (c) foods which result in extensive residue, (d) electricity, (e) exercise, (f) cathartics, exercise etc.

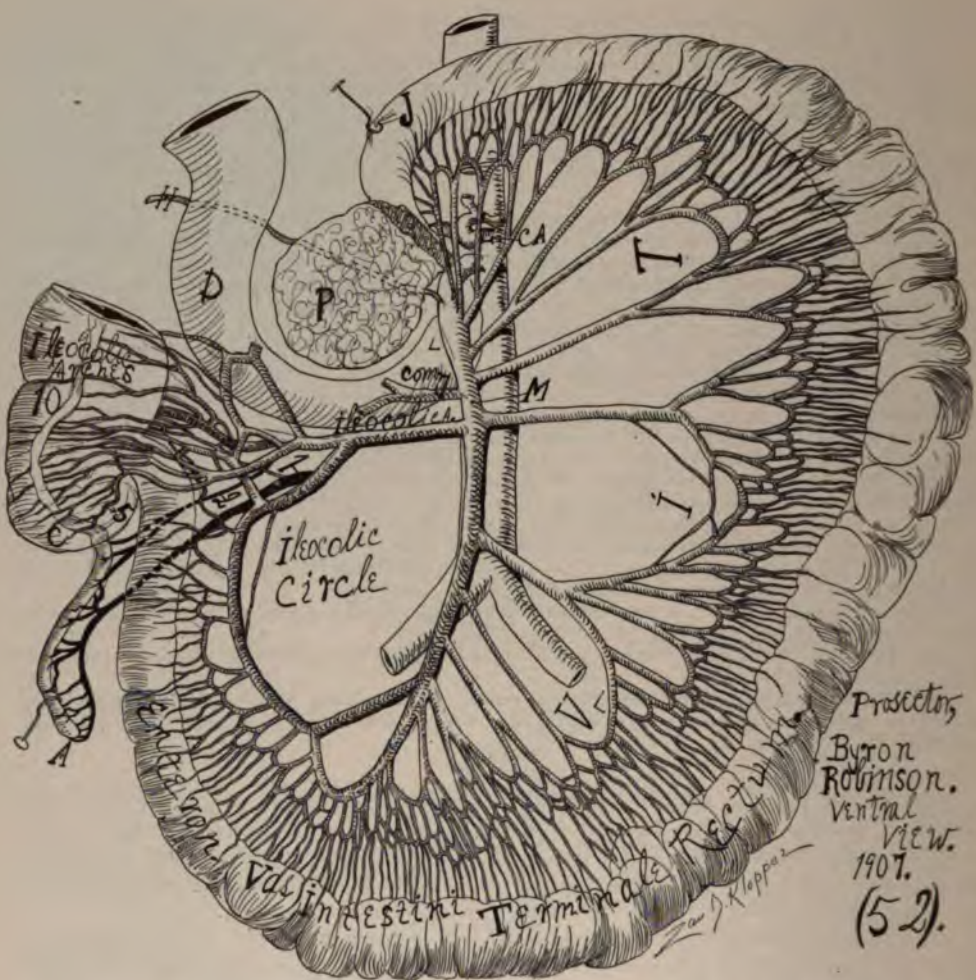
By cathartics a partial congestion of the "ileocolic circle" is accomplished, however insufficiently intense to absorb completely dense compromising peritoneal adhesions, with persistent visceral drainage (i. e. stimulation of the function of the tractus intestinalis—sensation, peristalsis, absorption, secretion)—by fluids, food, cathartics) producing two bowel evacuations daily sufficient blood may be enticed to the parts, not only for the maintenance of health but practically to absorb existing peritoneal adhesions. However it may be hopefully expected that therapeutics will discover a method of controlling the blood current and volume of the "ileocolic circle" and consequently of not only curing but furnishing a prophylaxis for perityphlitis and other diseases in adjacent structures. Blood cures diease. The noble Rokitansky observed that in subjects with cardiac valvular disease, tuberculosis was a rarity, the lung was congested and blood protected it from tuberculosis. In short a regurgitating aortic valve (with consequent pulmonary congestion) will cure or protect the pulmonary opices from tuberculosis.

Conclusions Regarding the "Ileocolic Circle."

Blood cures disease.

The apparatus for executing hyperaemia is the "inosculation circle."

The means of functionating (controlling the blood volume) the inosculation circle is by stimulating its automatic specialized peripheral ganglia, resulting in dilation of its vessels and congestion of the peripheral viscus.



ARTERIA APPENDICULARIS. "ILEO-COLIC CIRCLE." "ILEO-COLIC ARCHES." "STRAIGHT TERMINAL VESSEL." "ILEAL ARTERY." JEJUNAL ARTERY.

Fig. (52). Specimen injected, distended, and employed as a model by the artist, Dr. Zan D. Klopper. Ventral view.

A, appendix. B, ileum. C, coecum. M, jejunal artery (proximal mesenteric artery) I., arteria ileo-coecali; II., arteria ileo-coecalis dorsalis; III., arteria ileo-coecalis ventralis.

1, Appendicular artery (primary vessel) a vessel of moderate caliber arises from the "ileocolic circle" (i. e., from the "ileocolic artery and supplies the free half of the appendix. 2, appendicular artery (secondary vessel) a vessel of diminutive caliber arises from the "ileocolic arches" (i. e., from the ventral ileocecal artery) and supplies the basal portion of the appendix. The two appendicular arteries emit 16 branches to the appendix.

The "ileocolic circle" begins at the bifurcation of the jejunal artery and terminates by inosculation of the distal ends of the ileocolic and ileal arteries. The "ileocolic circle" originates the chief appendicuar artery.

The "ileocolic arches," numbering 10 are irregular in form, dimension and in caliber of the anastomosing arteries. The "ileocolic arches" appear as an independent structure, as an isolated apparatus, however, with powerful lateral colic and ileal anastomosis. The "ileocolic arches" originate the secondary appendicular artery.

The ample length (1 to 2½ inches) of the 'straight terminal vessel for ligating or clamping is evident in subject (52).

The "ileal artery" beginning at the bifurcation of the jejunal artery forms the left cir-

cumference of the ileocolic circle. The ileal artery emits 24 rami ilei. The rami ilei are of diminutive caliber at the distal ileum, hence disease is frequent from lack of blood supply.

The "jejunal artery" located between its origin from the aorta dorsal to the pancreas and its bifurcation into the ileocolic and ileal arteries to form the ileocolic circle, emits 6 rami jejunales of maximum dimension transportng a maximum volume of blood which preserves the health of the jejunum.

General remarks. The illustration was drawn on an extensive plan so that all vessels, arcs and circles could be visible. It may be noted that the opposite origin of the ileocolic artery there is a maximum enteronic branch (the 6th ramus jejunalis). This occurs frequenly in subjects.

The rational therapeusis is "*visceral drainage,*" which induces maximum blood volume in the inosculation circle and consequent maximum visceral elimination.

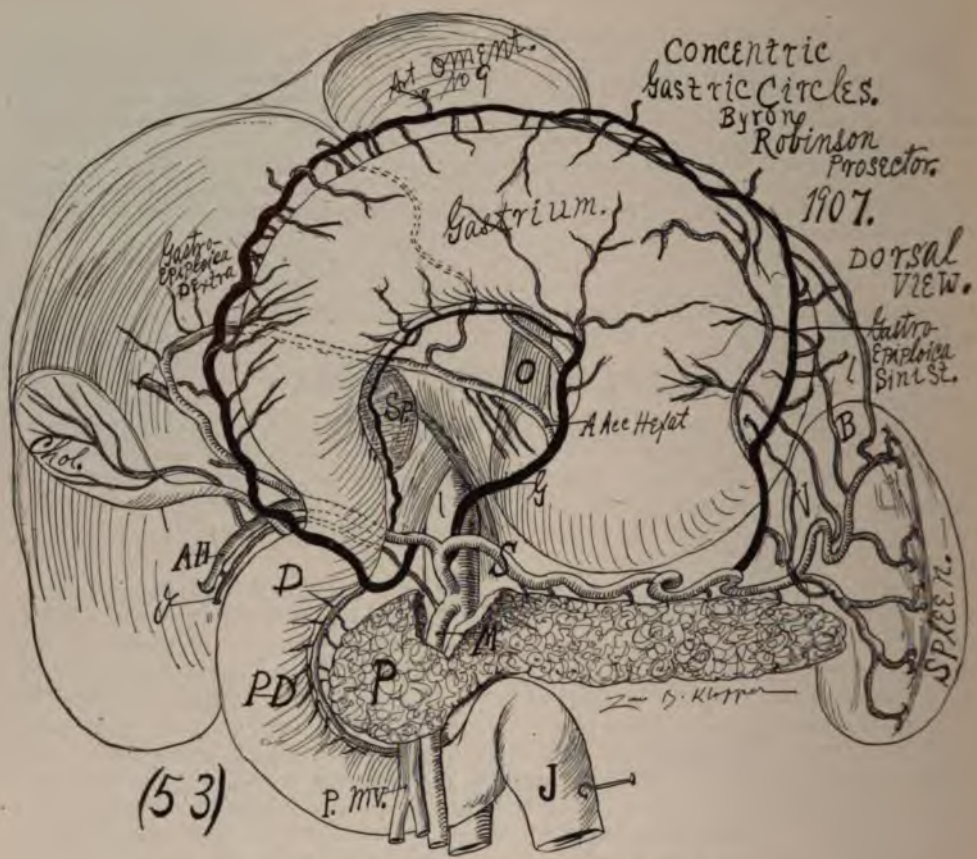
(b) THE "ILEOCOLIC ARCHES."

During the dissection of the abdominal viscera in 65 consecutive subjects I made the observation that there is located in the ileocolic angle a constant system of arches or circles. This heretofore undescribed constant system of circles or arches which I designate as "*ileocolic arches*" was discovered while exposing and illustrating the vascular supply of the appendix to which it is intimately associated.

A search of the current anatomic text books from the first great systematic work on Anatomy published (in 1791) by Samuel Thomas Soemmering (1755-1830) to the present time revealed no special suggestion of the arches of the ilecolic artery. Richard Quain in his collossal Anatomic Atlas published in 1830, presents some of the "ileocolic arches" but adds no name to them. It is not strange that anatomists should have neglected any special or detailed observation of structures in the ileocolic angle, for it is only a generation since surgery bloomed or became specialized in the ileocolic region.

As a generalization it may be stated that surgery is the father of anatomy. For example, in 1868 Doctor Joseph Hyrtl, professor of anatomy in Vienna, discovered that the dorsal and ventral renal vascular blades did not anastomose at their periphery though their peripheries were in actual contact. However, Hyrtl did not realize the vast signification of his wonderful and practical discovery because renal surgery was yet unborn. Nevertheless, Hyrtl was witty and capable of sufficient innuendo to note that his discovery maitained him in active business, furnishing corrosion specimens of circulation of the kidney for European museums. A number of years ago by the aid of corrosion anatomy I solved independently the same problem as Hyrtl. However, on perceiving by reference to the literature that Hyrtl had discovered it over a score of years previously, I at once eponymized it "Hyrtl's exsanguinated renal zone" (see DaCosta's edition of Gray's Anatomy, 1905-07, page 1423). As a surgeon I saw directly that Hyrtl's exsanguinated renal zone was invaluable and that it was the elective line of cortical renal incision with minimum hemorrhage. Hence renal incision surgery is the father of renal anatomy. Again, since the blooming of appendectomy surgery became the father of appendicular anatomy. When physicians discover that an organ is subject to definite disease which can be remedied by incisions, surgery becomes the father of its applied anatomy.

It requires but a few special detailed dissections in the ileocolic angle of perfect specimens to realize a system of distinctly marked circles or "ileocolic arches." A peculiar whorl or knot of independent vascular arches is plainly evident, located in the ileocolic angle. Whether the detailed exposition and description of the special ileocolic vascular arches will be of any utility to medical science remains to be proved, as is the case with all progressive views. It appears to me that the ileocolic vascular arches are a primordial vascular landmark, a remnant of some ancient, vast anatomic structure as the appendix. At



"CONCENTRIC GASTRIC CIRCLES."

Dorsal view (circles reflected proximalward). Drawn from my personal dissection by Dr. Klopper. Middle-aged man.

Fig. 53. Presents the dorsal view of the two "concentric gastric circles" (in black). The gastro-hepatic circle, the lesser of the two concentric circles, is formed by the anastomosis of the gastric and hepatic artery, and the circle is completed by the hepatic branch. This circle is located along the lesser gastric curvature. The gastro-splenic circle, the greater of the two "concentric gastric circles" lying along the greater gastric curvature, is formed by the anastomosis of the gastro-epiploica sinistra and dextra with hepatic and splenic branches. O, esophagus. In this subject the celiac axis is inclined toward the right; Pmv, vasa mesenterica proximal; F, jejunum. Observe the duodenum clamped between the aorta jejunal artery, or vasa mesenterica proximal, which frequently produces gastro-duodenal dilatation. The jejunal artery is inseparably related to gastro-duodenal dilatation during the progress of splanchnoptosia. Note the plan of the bloodvessel to the stomach, viz., (a) trunk (celiac axis); (b) arch (concentric gastric circles); (c) straight terminal vessel of the stomach (the vessels emerging from the gastric circles).

Note the hepatic artery originating from the jejunal artery.

The arteria gastro-hepatica forms an inosculating loop with the ramus hepaticus sinistra intimately relating the haemogenic organ to both stomach and liver. The concentric gastric circles are typical "inosculation circles," the function of which is to engorge the stomach for digestive purposes.

The intimate and profound relations of the blood supply of the stomach and spleen is evident in Fig. 53, through the vasa brevia. Note: The "Duodenal circle."

present the arches of the ileocolic artery are in a state of atrophy, irregular, angular and distinctly related to the coecum. The ileocolic arches are so modified in position, dimension and relations by the evolutionary process (attitude

and food) in regard to the appendix that at present the appendicular artery does not always originate from them, however one appendicular artery arises from the ileocolic arches in 95 per cent. of subjects. One factor alone will immortalize the "ileocolic arches," as it will the "ileocolic circle," and that is they originate one or more of the appendicular arteries in perhaps 95 per cent. of subjects. The appendix in 65 subjects possessed on an average practically two arteries for each individual.

Topography of the "Ileocolic Arches."

Form of the "ileocolic arches" are irregular, acutely angular, elongated (see figures).

Dimension of the ileocolic vascular arches are relatively limited for the excessive diameter of the enclosing arteries. The anastomosing arteries are of maximum dimension.

Position of the ileocolic vascular arches is in general located an inch proximalward and an inch medialward from the ileocolic angle.

Number. In 65 subjects the minimum number of "ileocolic arches" was 1, the maximum number was 14, and the average number was 6 (exactly 6.41).

Relation of the arches of the ileocolic artery is distinctly with the cecum.

The "Ileocolic arches" are practically a segment of the ileocolic artery. The "ileocolic arches" anastomose with those of the appendix, see figures (38), (40), (64), (47), (50), (59).

Utility of the vascular arches of the ileocolic artery is to furnish a nominal maximum, continuous blood supply direct and collateral to the cecum (and primordially to the appendix—an ancient stomach).

Percentage of subjects possessing marked, prominent ileocolic vascular arches is 80 per cent.

Comparison. The colic angles—ileocolic, hepatico colic, splenico colic, sigmoid angle—possess an accumulation of vascular arches or circles—ancient vascular landmarks. The "ileocolic arches (or circles of anastomosis) resemble those of the sigmoid. The "ileocolic arches" are not end or terminal arteries, for the entire body may be injected any one of the "ileocolic arches" or circles. The "ileocolic arches" may be ligated or clamped without compromising the "ileocolic circle."

The "ileocolic arches" are a complex, independent system of mesenteric arches, marking a primordial vascular landmark—the junction of the ileum and colon. The coecum and appendix are located in the ileocolic angle. They are a primordial vascular landmark which attend the coecum (and perchance the appendix), they resemble the rich vascular anastomosis of the mesosigmoid arches. The dimensions of the "ileocolic arches" are relatively small for the considerable dimensions of the anastomosing arteries.

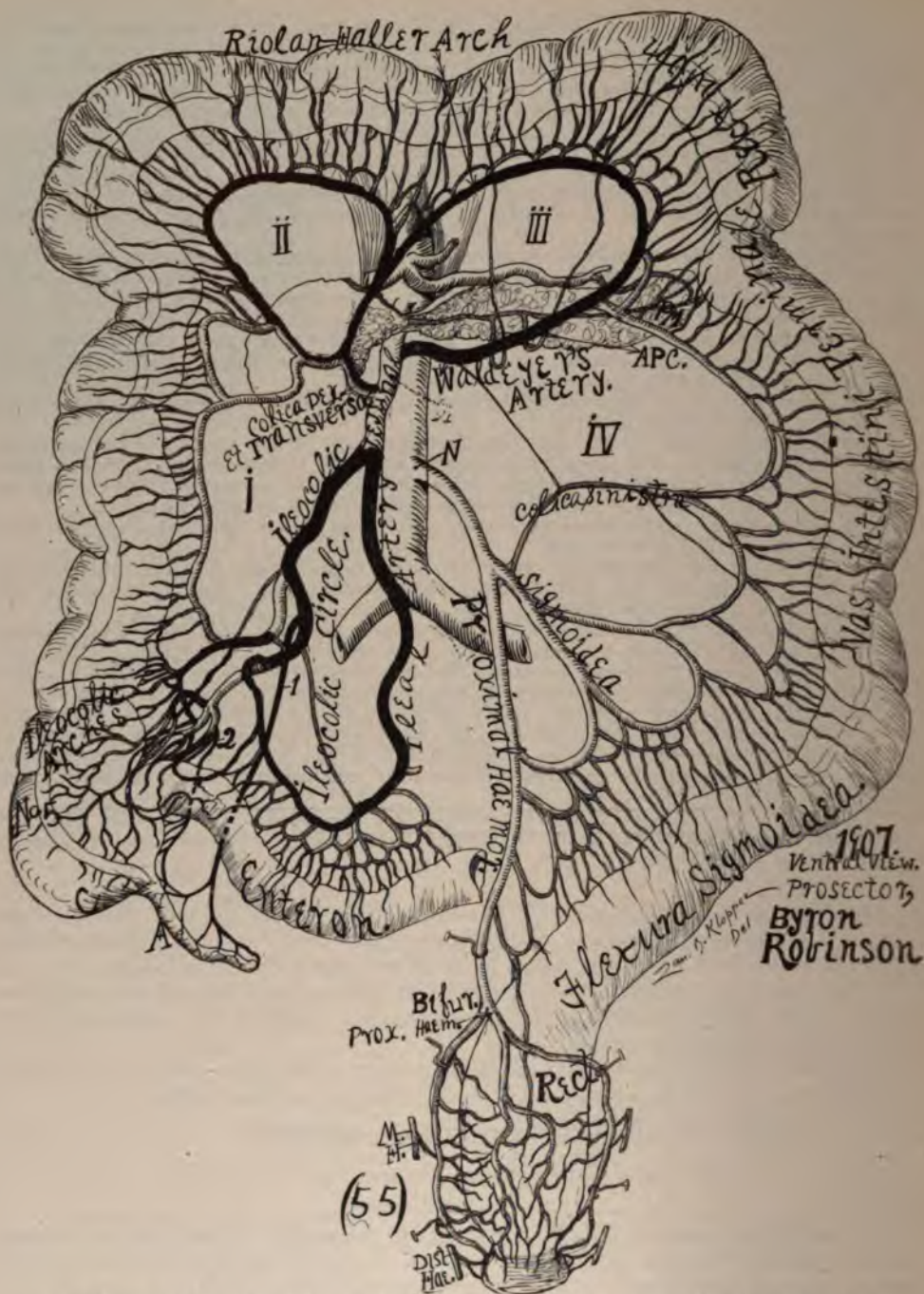
I found no reference in literature to what I term the "ileocolic arches," they are, so far as I can learn a product of my original investigations.

(c) "STRAIGHT TERMINAL VESSELS."

(Vas intestini terminale rectum.)

The "straight terminal vessel" extends from the ramus iliacus, "ileocolic arches" and ramus colicus to the distal ileum, coecum and right colon.

Blunt dissection would free with facility ample length of the "straight terminal vessel" extending between the ramus iliacus "ileocolic arches" and ramus colicus for clamping or ligating without compromising the ramus colicus ("ileocolic circle") or ramus colicus. The "straight terminal vessel" of the distal ileum (ramus iliacus) is short, straight, small and limited in caliber and in number—perhaps six—hence limited blood supply to the distal ileum with consequent disease, tuberculosis, typhoid ulceration. The "straight terminal



APPENDICULAR ARTERY. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "STRAIGHT TERMINAL VESSEL." ILEAL ARTERY. "ENTERO-COLIC CIRCLE." (RIOLAN-HALLER ARCH). "MAJOR MESOCOLIC CIRCLES." "ILEAL ARTERY." "ARTERIA PANCREATICA. COLICA ET OMENTALIS (APC). (ARTERIAL FIELDS). JEJUNAL ARTERY.

Fig. (55). Specimen injected, dissected and employed as a model by the artist, Dr. Zan D.

Klopper. Ventral view. A, appendix. B, ileum. C, cecum. M, proximal mesenteric artery. I., arteria ileocolica. II., arteria ileocalis dorsalis. III., arteria ileocecalis ventralis. N, distal mesenteric artery. VIT, vas intestini tenuis.

1, Appendicular artery (primary vessel) a vessel of limited caliber arises from the "ileocolic circle" (i. e., from the ileocolic artery distal to the emergence of the ramus colicus and supplies the free half of the appendix. 2, appendicular artery (secondary vessel) a vessel of diminutive caliber, arises from the "ileocolic arches" (i. e., the dorsal ileocecal brand) and supplies the basal portion of the appendix. The two appendicular arteries inosculate forming arches, resembling the mesenteric arches. The two appendicular arteries emit 12 branches to the appendix. The appendicular arteries arise from the ileocolic arches and ileocolic circle. Limited blood supply to the atrophic appendix and its compromization by contracting periappendicular peritoneal adhesions, due to psoas trauma, renders the appendix a dangerous and treacherous organ—dangerous because it kills and treacherous because its capricious course cannot be prognosed.

The "ileocolic circle," irregular in circumference, divided by an artery, originates the main appendicular artery. It is formed by the bifurcation of the jejunal artery and the anastomosis of their distal branches (ileocolic and ileal). The ileocolic circle is of unusual dimension.

The "ileocolic arches," 5 in number, are irregular in form, dimension and calibre of anatomosing branches. They appear as an isolated apparatus. an independent structure with limited lateral colic and ileal anastomosis. There is resemblance of the ileocolic arches to the arches in other colonic flexures, viz.: hepatic, splenic, and sigmoid. The dorsal ileocecal artery (the darker) is of greater caliber than the ventral).

The "ileal artery," assuming a sinuous course form the left circumference of the ileocolic circle. It extends from the bifurcation of the jejunal artery to its anastomosis with the ileocolic.

"Entero-colic circle" or the transverse mesocolic arch, arcus transversus mesocolicus, is broken, interrupted by the accessory transverse artery (Waldeyer's artery). Waldeyer's artery multiplies the arches in the transverse mesocolon and fortifying the integrity of the peripheral colonic circulation. Multiple arches enhance peripheral circulation. The arteria colica dextra and arteria colica transversa possess a common trunk.

I have designated the arteria fields (areae arteriacae) as I., II., III., IV. The practical arterial renal fields are I. & V., The arterial fields marked II. and III. are those of the transverse mosocolon. They are mobile and of little practical value in peritonotomy except to mark the boundaries of vascular arcs which should not be ligated or clamped.

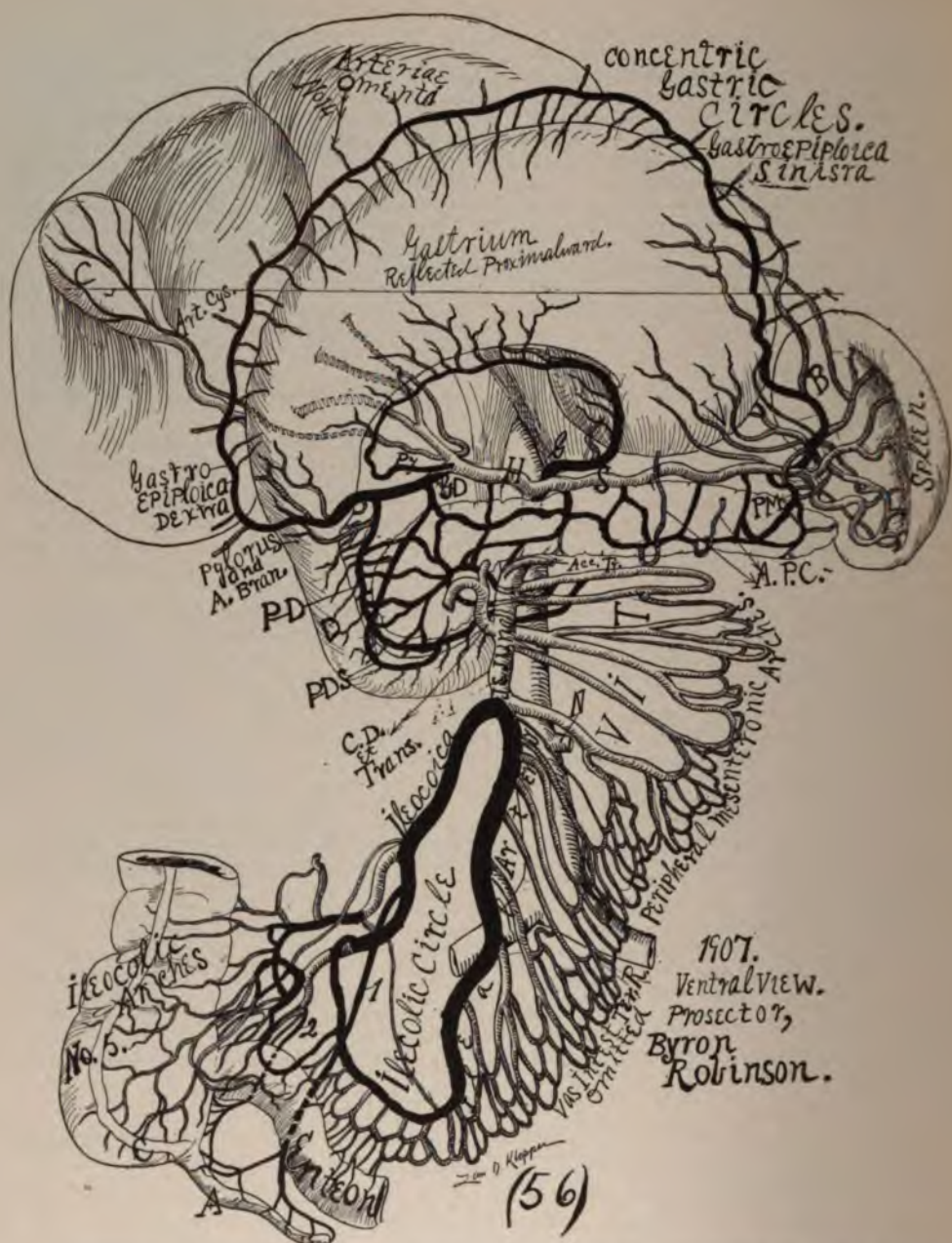
The "jejunal artery" extending from its origin in the aorta dorsal to the pancreas to its bifurcation into ileal and ileocolic arteries is 3 inches in length. Arteries emerge, in general, from the four quarter circumference of the jejunal artery. The jejunal artery is of significant importance clinically on account of its compression of the duodenum during splanchnoptosia resulting in gastro-duodenal dilatation.

General remarks. In general a view of Fig. (55) one notes: 1st, a series of major mesocolic arches; 2nd(a series of minor vascular arches imposed on the circumference to the major arches; 3rd. an accumulation of vascular arches in the colonic flexures (ileocolic, hepatic, splenic and sigmoid). The trunk of the distal mesenteric artery bifurcates (70 per cent of subjects). Observe the abundant blood supply to the rectum by the bifurcation of the proximal haemorrhoidal artery. Observe the "straight terminal vessel" as regards to ligating or clamping. Note two arteries crossing the arterial fields III. arising from the vessels of the pancreas (I cannot find these arteries in textbooks), I term this vessel, arteria pancreatica colica.

tery is located between the junction of the ileal and jejunal arteries and the emergence of the ramus colicus. See figures (26), (33), (38).

The *appendicular artery* may arise (2) from the arteria ileocaecalis dorsal (70 per cent.) or ventral (25 per cent.) (ileocoecail artery), see figures (30), (37), (34), (35), (38), (39), (40), (41), (45), (46), (47), (50), (52), (54), (56), (57), (62), (65).

The *appendicular artery* may originate (3), from the ramus iliacus (45 per cent.) i. e., the right circumference of the "ileocolic circle"). The ramus iliacus extends from the trifurcation of the ileocolic artery to the distal inosculation with the ileal artery. See figures (21), (37), (41), (46), (47), (52), (54), (55), (57), (59), (62), (64), (65). The appendicular artery may arise (4), from the ramus colicus (3 per cent.) The ramus colicus extends from the trifurcation of the ileocolic artery to its inosculation with the distal directed branch of the colica dextra. In two subjects among the 65 consecutive dissec-



ARTERIA APPENDICULARIS. "ILEOCOLIC CIRCLE." "ILEOCOLIC ARCHES." "VAS INTESTINI TERMINALE RECTUM." "ILEAL ARTERY." "JEJUNAL ARTERY." "MAJOR MESOCOLIC CIRCLES." "CONCENTRIC GASTRIC CIRCLES." "DUODENAL CIRCLE." "PANCREATIC CIRCLE."

Figure (56). Specimen injected, dissected, employed as a specimen by the artist, Dr. Zan D. Klopper. Ventral view. A, appendix. B, ileum. C, cecum. I., atteria ileocolica. II., arteria ileocoecalis dorsalis. III., arteria ileocoecalis ventralis.
Appendicular artery identical with Fig. 55.
This figure 56 is from the same subject as figure 55.

The "concentric gastric circles" in Fig. (56) are reflected proximalward presenting self explanation.

The rami ilei and rami jejunales are accurately presented.

General remarks. The anastomotic apparatus uniting the celiac axis to the proximal mesenteric artery is evident in Fig. (56). I have termed this anastomotic apparatus arcus duodenalis and arcus pancreaticus—both important vascular arches. The mesenteronic arches are shown minus the "vas intestini terminale rectum." A.P.C. is the arteria pancreatica colica not presented in textbooks. Note the contrast between the blood supply of the cecum (the rich ileocolic arches) and the blood supply of the appendix (the two limited appendicular arteries).

tions the ramus colicus originated the appendicular artery. See figures (26), (42).

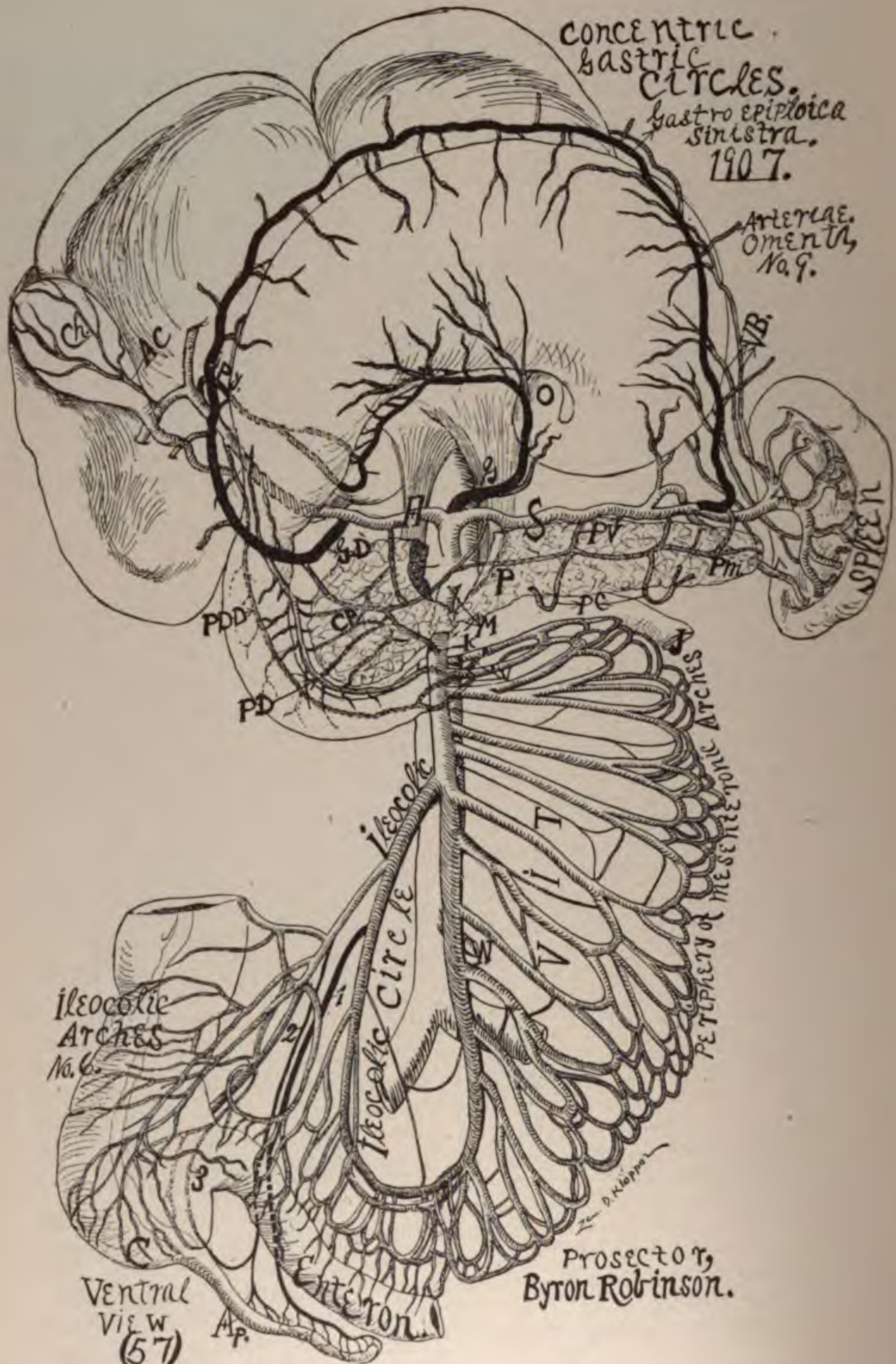
The trunk of the ileocolic artery and the ramus iliacus are continuous and identically the same vessel, i. e., both constitute the right circumference of the "ileocolic circle." Hence practically there are four sources for the appendicular artery, viz., from the ileocolic trunk—51 per cent.—(the right circumference of the "ileocolic circle")—i. e., the ileocolic artery—from the ramus iliacus—45 per cent.—(the right circumference of the "ileocolic circle")—i. e., the ileocolic artery from the "ileocolic arches"—95 per cent.—i. e., the ileocoecal artery and from the ramus colicus (3 per cent.) The arterial blood supply of the appendix practically originates equally from the "ileocolic circle" (96 per cent.) and "ileocolic arches" (95 per cent.).

At first, in attempting during dissection, to classify the origin of the appendicular blood supply confusion appears rampant. However, by adopting a simple classification of constant anatomic structures as the "ileocolic circle" and "ileocolic arches" the plan of origin of the appendicular artery is evident. In general there is one main appendicular artery which primarily arises from the right border of the "ileocolic circle" (i. e., the ileocolic artery), and secondarily one arises from the "ileocolic arches (i. e., the ileocoecal artery). The appendicular artery arises practically 3 times as frequent from the dorsal ileocoecal artery as from the ventral ileo-coecal. In 65 consecutive dissections the appendicular artery passed constantly dorsal to the distal ileum. The appendicular artery passes from its origin distalward, dorsal to the terminal ileum between the meso-appendicular blades to terminate in some 12 minor branches which supply the appendix. In 65 consecutive subjects the average number of appendicular arteries was 2 for each individual. The principal appendicular artery determines the form of the mesoappendix coursing along the free margin of the mesoappendix. At its origin the artery may be removed at some distance from the free margin of the mesoappendix. In subjects with abundant panniculus adiposus the chief artery may be located a moderate distance from the free margin of the mesoappendix.

In 65 subjects the main appendicular artery coursed to the tip, free end of the appendix and usually curved around the tip and penetrating the appendix, directly according to the common method.

It would appear that the primary appendicular artery supplies perhaps an average of ¾ of the free appendix, while occasionally a tertiary appendicular artery supplies the remaining portion or base and anastomoses with coecal branches. The secondary branches of the principle appendicular artery decrease in length toward the free end.

In certain subjects the mesoappendix appears to fail toward the free end of the appendix, however, the appendicular artery constantly pursues its course to the free appendicular tip. In no subject in our 65 dissections did the appendicular artery fail to extend distinctly to the free end of the appendix. When the appendicular branches arise at the appendicular border they divide into numerous branches to supply the appendicular serosa, mascularis and muscosa.


Concentric
Gastric
Circles.
Gastro epiploica
sinistra.
1907.
Arteriae.
Omenti,
No. 9.
Spleen
Periphery of Mesenteric Arches
Ileocolic
Ileocolic Circle
Ileocolic Circle
Ileocolic
Arches
No. 6.
Ventral
View
(57)
Enteron.
Prosector,
Byron Robinson.

ARTERIA APPENDICULARIS, "ILEOCOLIC CIRCLE," "ILEOCOLIC ARCHES," "STRAIGHT TERMINAL VESSEL." "ILEAL ARTERY." "JEJUNAL ARTERY," "CONCENTRIC GASTRIC CIRCLES," "DUODENAL, CIRCLE," "PANCREATIC CIRCLE."

Figure (57). Specimen injected, dissected, and employed as a model by Dr. Zan D. Klopper. Ventral view. A, appendix. B, ileum. C, coecum (nonsymmetrical). I, arterial ileo-colica. II, arteria ileocoecalis dorsalis. III, arteria ileocoecalis ventralis.

1, Arteria appendicularis (primary vessel), a vessel of moderate caliber, arises from the ileocolic circle (i. e., from the ileocolic artery) and supplies the free portion of the appendix. 2, appendicular artery (escondary vessel), a vessel of dimunitive caliber, arises from the "ileocolic arches" (i. e., from the common ileocecal artery) and supplies the basal portion of the appendix. 3, appendicular artery (tertiary vessel), a vessel of diminutive caliber, arises from the ileocolic arches (i. e., the dorsal ileocecal artery). The appendicular arteries inosculate to form meso-appendicular arch. The 3 appendicular arteries emit 14 branches to the appendix.

The "ileocolic circle" paritioned by vessels, originates the main appendicular artery and presents on its distal circumference a series of minor vascular arches.

The "ileocolic arches," six in number, are irregular in form, dimension and in caliber of anastomosing vessels. The ileocolic arches originate the two appendicular arteries.

The "ileal artery" is a continuation of the "jejunal artery" from the emergence of the ileocolic. The rami ilei with their meso-ileac arches are presented in this illustration. Some arches present duplicity.

The "concentric gastric circles" are reflected proximalward. The stomach lies between the concentric circles.

General remarks. The anastomotic apparatus between the celiac axis and proximal mesenteric artery is evident. I term it:—arcus duodenalis and arcus pancreaticus, or the duodenal and pancreatic circles. There is a tendency in the mesentronic arches toward duplicity. In general the mesenteronic arches appear as a major series of arches with a multiple series of minor vascular arches imposed on their periphery.

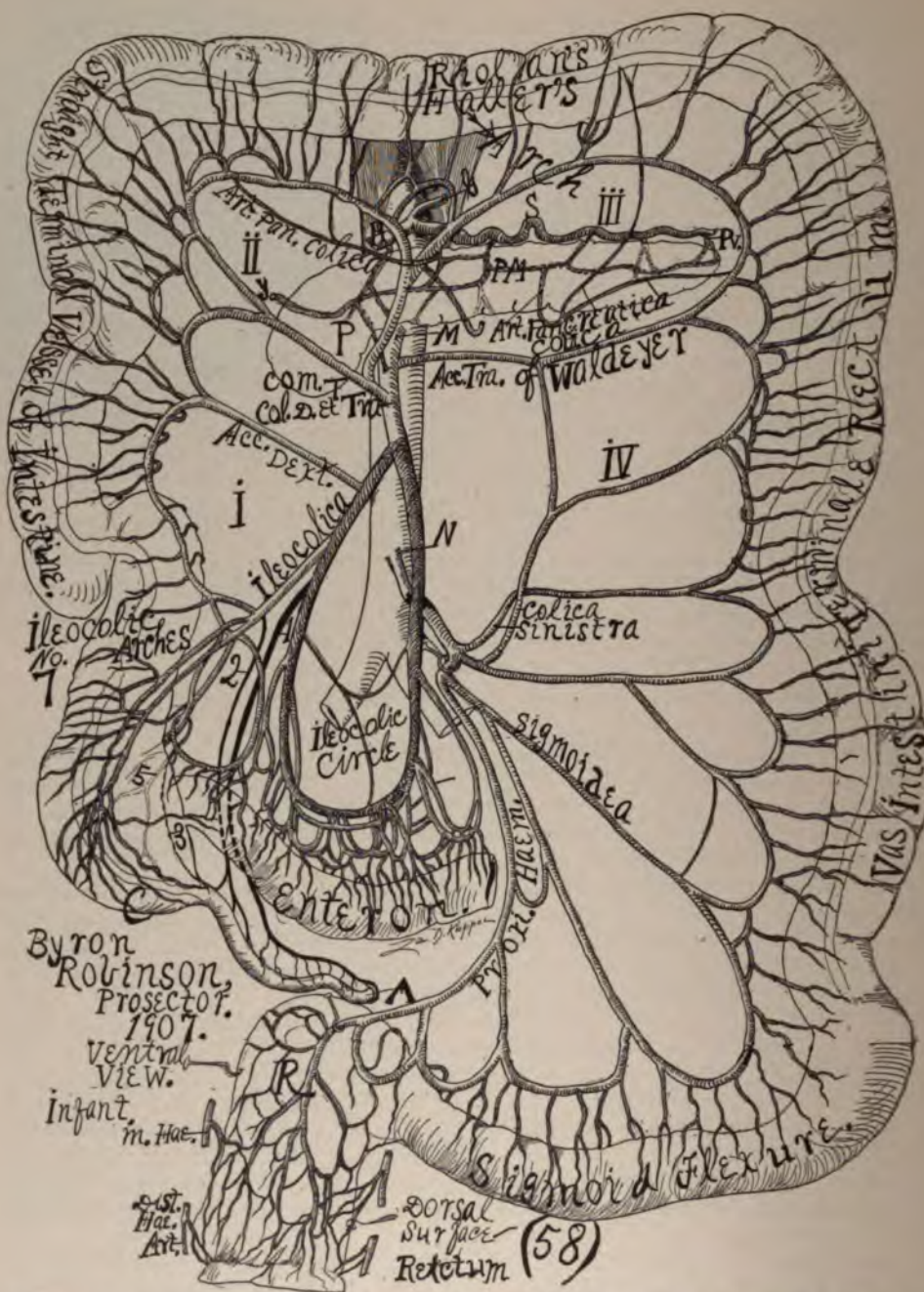
The branches supplying the appendicular serosa may be observed pursuing a tortuous anastomotic course and especially if perityphilitis, (peritonitis) exist. The appendicular arteries noted immediately beneath the appendicular serosa are prominent in dimensions, they divide and asatomose freely along the surface of the appendix. Practically the appendicular branches arising at the appendicular hilum form a double vascular system which supply laterally the three coats of the appendix.

An extensive network of vessels attends the appendicular serosa, muscularis and muscosa—especially the muscosa. The mesoappendix is highly supplied by a delicate network and the vessels not infrequently adjacent to the appendix connect the larger appendicular vessel into loops—mesoappendicular loops, resembling the mesenteric arches, see figures (36), (2), (3), (4), (13), (17), (20), (39), (40), (41), (47), (51),(55), (56), (57), (59), (62), (64), (65). During the injection of the appendicular artery in 65 subjects I observed that the anastomoses among the appendicular vessel was rich and also abundant between the appendicular and coecal arteries. Generally the principle artery emits one or more branches to the ileocoecal fold. Perhaps this is the artery that Jonesco terms *"artere recurrent ileocoecale."* My testimony is that the ileocoecol fold is rich in fine blood vessels. I may say practically that our injections presented no vascular connections between the appendix and right ovary.

The circulation of the ovary and appendix is practically established in embryo life previous to the adjacent association of ovary and appendix hence this is strong argument that no acquired relations could arise.

In the excellent and monumental work of Howard A. Kelly and E. Hurdon on the *"Vermiform Appendix"* the arrangement of the arteries to the appendix is classified into four types.

Type 1, included the subjects in which the single appendicular artery supplies the enteron-appendix, but no portion of the coecum except by a minute anastomatic channels. The origin of the appendicular artery—type 1 maybe



ARTERIA APPENDICULARIS, ILEOCOLIC CIRCLE, ILEOCOLIC ARCHES, STRAIGHT TERMINAL VESSEL, ILEAL ARTERY, JEJUNAL ARTERY, ENTEROCOLIC CIRCLE, MAJOR MESOCOLIC CIRCLES, ARTERIA PANCREATICA OMENTALIS.

Figure (58). Specimen injected, dissected, employed as a model by Zan D. Klopper. Ventral view. A, appendix. B, ileum. C, coecum (nonsymmetrical). I, arterial ileo-colica. II., arteria ileocoecalis dorsalis. III., arteria ileocoecalis ventralis.
For detailed description see Fig. 57.

The Riolan-Haller arch is interrupted by a Waldeyer artery, enhancing the integrity of the peripheral colonic circulation. Multiple arches increase and fortify circulation in the periphery.

The arterial fields I. and IV., are renal, II. and III. are arterial fields of the transverse mesocolon, circumscribe the duodenum and pancreas. The arterial fields (I. and II.), (III. and IV.) are bilateral (proximal and distal) and practically constant, however, varying in dimension and location.

General remarks. Fig. (58) presents, in general, a series of major mesocolic arches, however, with an extremely limited number of minor vascular arches imposed on their periphery. The four colonic flexures (ileocolic, hepatic, splenic, sigmoid) present accumulations of vascular arches. The trunk of the distal mesenteric artery trifurcates (30 per cent of subjects). The arteria pancreatica colica is duplicate. The pancreatico-colic artery I have noted in no textbook. The multiple major arches of this colon insure peripheral circulation. Of the bilateral proximal and distal major mesocolic circles or arterial fields, (1) the right renal arterial field is perhaps the most constant. Practically the right distal major mesocolic circle is constant. It varies extremely in form and dimension but exists in each subject. It varies considerable in location. It may be subject to one or more partitions by cross arteries. The right, distal, major mesocolic circle (I) is practically as constant as the "ileocolic circle." but the ileocolic circle is a primordial, developmental, vascular landmark—the vascular landmark between enteron and colon.

from (a), ileocolica; (b), dorsal ileocoecal, (c), ventral ileocoecal; (d), mesenteric loop. Thirty per cent. of subjects belong to this type.

Type 2. Includes those subjects with more than one appendicular artery, the primary appendicular artery arising as type 1 supplies 4/5 of the distal appendix, the proximal 1/5 of the appendix is supplied by a secondary, or perchance a tertiary. Twenty-five per cent. of subjects belong to this type.

Type 3 includes those subjects in which single or multiple appendicular arteries supply both the appendix and a considerable portion of the coecum.

Type 4 includes those cases in which the meso-appendix possesses meso-appendicular arches—rare.

As I have adopted a totally different classification I simply leave this with the reader as one form.

The following data arose from 65 consecutive dissections of the appendicular arteries.

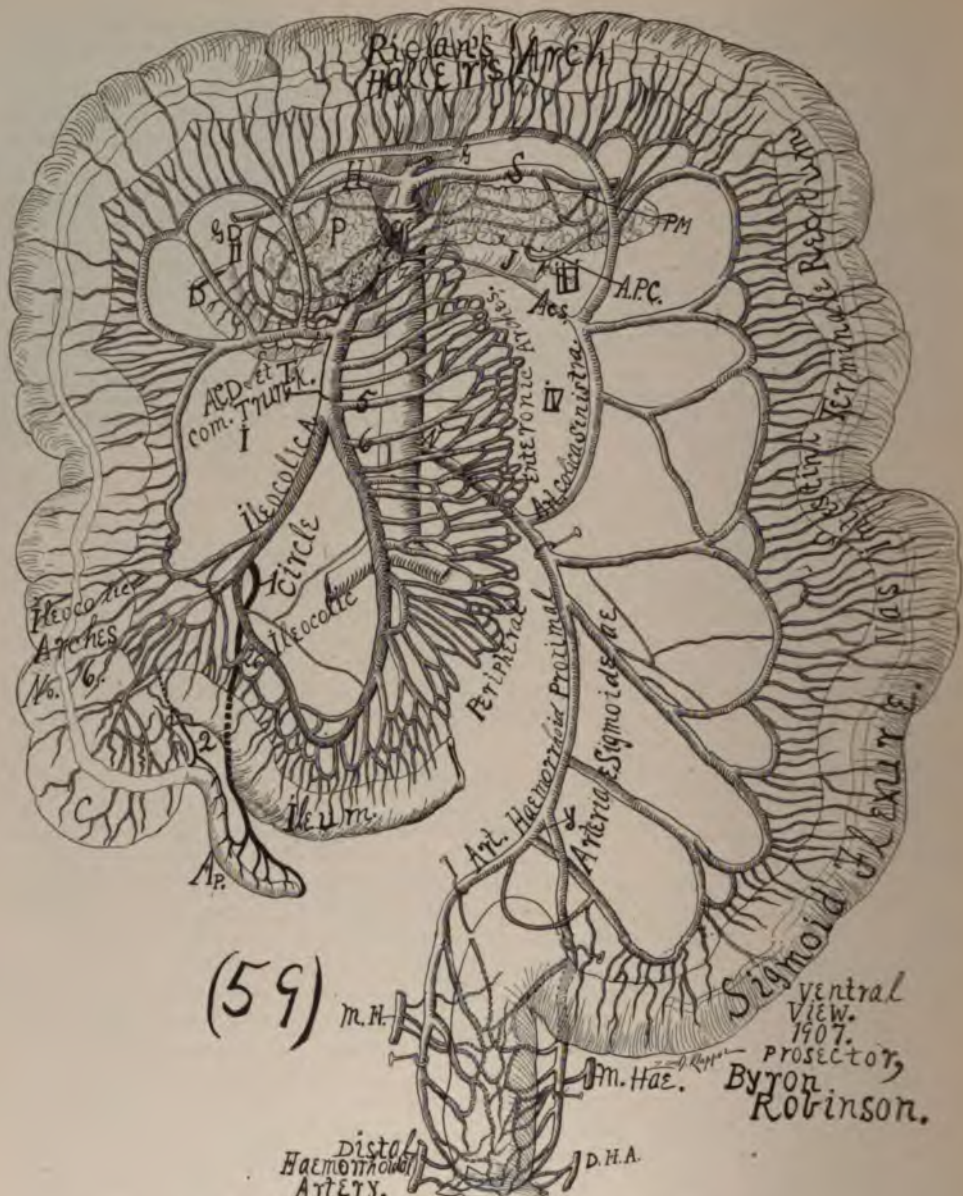
In 65 subjects 33 per cent. possessed 1; 39 per cent., 2; 14 per cent., 3; 3 per cent., 4, and 2 per cent., 5 appendicular arteries. Practically each individual possessed an average of 2 appendicular arteries.

In 65 subjects the appendicular artery arose 51 per cent. from the "ileocolic circle." Seventy per cent. from the dorsal ileocoecal, 25 per cent. from the ventral ileocoecal, 45 per cent. from the ramus iliacus, 3 per cent. from the ramus colicus. Hence since the ileocolic artery and ramus iliacus compose the right circumference of the "ileocolic circle" their combined percentage is (ileocolic, 51 per cent. plus 45 per cent. ramus iliacus), 96 per cent., i. e., the appendicular artery originates from the right border of the "ileocolic circle" in 96 per cent. of subjects. Also the combined percentage of the dorsal ileococal (70 per cent.) and ventral ileocoecal (25) is 95 per cent., i. e., the origin of the appendicular artery from the ileocoecal artery (i. e., the "ileocolic arches"), occurs in 95 per cent. of subjects. The ramus colicus originated the appendicular artery in 3 per cent. of subjects. The ileocolic artery, dorsal and ventral combine and anastomose to form on an average of half dozen "ileocolic arches" for each individual. Therefore it may be stated that the appendicular artery arises from the "ileocolic circle" in 96 per cent. of subjects, from the "ileocolic arches" in 95 per cent. of subjects and from the ramus colicus in 3 per cent. of subjects.

Origin of the Appendicular Artery.

For the classification of the origin of the appendicular artery I shall assume the following four sources, viz., the ileocolic artery and its three primary branches, arteria ileocoecalis, ramus iliacus, ramus colicus.

The ramus ileocolic dorsal (70 per cent.) originates the appendicular artery



APPENDICULAR ARTERY. ILEOCOLIC CIRCLE. VAS INTESTINI TERMINALE RECTUM. ILEOCOLIC ARCHES. ILEAL ARTERY. JEJUNAL ARTERY. MAJOR MESOCOLIC CIRCLES. ARTERIA PANCREATICA COLICA OMENTALIS (APC). ENTERO-COLIC CIRCLE.

Figure (59). The specimen was injected, dissected and employed by the artist, Dr. Zan D. Klopper as a model. Ventral view. A, appendix. B, ileum. C, coecum (nonsymetrical). I, arteria ileocolica. II, arteria ileocoecalis dorsalis. III, arteria ileocoecalis ventralis.

1, Appendicular artery (primary vessel), a vessel of moderate caliber, arises from the "ileocolic circle" (i. e., the ileocolic artery) and supplies the free 2/3 of the appendix. 2 appendicular artery (secondary vessel), a vessel of diminutive caliber arises from the ileocolic arches (i. e., from the dorsal ileoceal artery) and supplies the basal portion of the ap-

pendix. The two appendicular arteries inosculate forming a meso-appendicular arch resembling the mesenteronic arch. The two appendicular arteries emit 12 branches to the appendix. Practically the appendicular artery arises from the "ileocolic circle" or "ileocolic arches."

The ileocolic circle is formed by the bifurcation of the jejunal artery into the ileal and ileocolic arteries and completed by their distal anastomosis, originates the main appendicular artery. It is divided by arteries.

The ileocolic arches, formed by the combined anastomosis of the dorsal and ventral ileocecal arteries number six. They are irregular in form, dimension and in the caliber of the anastomosing arteries. They appear as an independent structure, an isolated apparatus with limited lateral colic and ileal anastomosis.

The straight terminal vessel is evident in Fig. (59) and of ample length (1 to 2 inches) for clamping and ligating without compromising the mesocolic arches.

The ileal artery extending from the mergence of the ileocolic artery to its distal anastomosis with the same, emits 22 rami ilei, the caliber of which gradually decreases until the cecum is reached. The distal rami ilei are insufficient in caliber to protect the ileum from disease (ulceration, perforation).

Enterocolic Circle or the great Riolan-Haller arch is interrupted by the accessory transverse artery (ACS)—or Waldeyer's artery which passes directly from the ileal artery (proximal mesenteric) to inosculate with the proximal branch of the colica sinistra.

The arterial fields, bilateral—proximal and distal—are distinct. The bilateral proximal arterial fields—major mesocolic circles—(II and III) circumscribe the duodenum and pancreas, also part of the stomach. The bilateral distal arterial fields—major mesocolic circles—(I. and IV.) practically circumscribe the kidneys.

The jejunal artery, extending from its origin in the aorta, dorsal to the pancreas to its bifurcation into the ileocolic and ileal arteries emits 5 rami jejunales horizontalward to supply the eight feet of jejunum. The rami jejunales are of maximum caliber transmitting a maximum blood volume which acts as a prophylactic and cure for jejunal disease. Maximum digestion and maximum blood supply occur in the jejunum—with the least disease. The jejunal artery by compression of the duodenum results in gastro-duodenal dilatation.

General remarks. In Fig. (59) there is evident accumulation of vascular arches in the colonic flexures. There exists an arteria pancreatica colica extending from a branch of the splenic to the splenic flexure of the colon. There exists in Fig. (59) multiple major mesocolic circles but limited minor vascular arches imposed on their periphery—which fortifies peripheral circulation. In the mesenteron there appears a series of major mesenteronic arches on which are imposed a series of minor vascular arches which fortifies, increases the peripheral circulation. Maximum, peripheral circulation (functionally localized) is especially required in the enteron—the business portion of the digestive tract. Note the rich rectal blood supply. Observe the contrast of blood volume to the appendix and sigmoid and remember the clinical disasters in each.

The rectum is supplied by (a), the proximal haemorrhoidal artery; (b), by the middle haemorrhoidal artery (M. H.); (c) the distal haemorrhoidal artery.

almost three times as frequent as the ramus ileocolic ventral (25 per cent.). The ramus iliacus (45 per cent. originates the appendicular artery 15 times as frequent as the ramus colicus (3 per cent.).

The appendicular artery arises:

I.	From the arteria ileocolica	51%
II.	From the ramus ileocoecalis { Dorsal ileocoecalis 70% / Ventral ileocoecalio25 % }	95%
III.	From the ramus iliacus	45%
IV.	From the ramus colicus	3%

The arteria ileocolica (Trunk) plus the ramus iliacus are continuous, identically the same artery, i. e., they unite to form the right circumference of the "ileocolic circle" hence their combined percentage (96 per cent.) represents 51 per cent. (ileocolica) plus 45 per cent. (ramis iliacus). The "ileocolic arches" originate the appendicular artery in 95 per cent. of the subjects, consequently there is practically two origins from the appendicular artery, viz., the "ileocolic circle" (96 per cent.) and the "ileocolic arches" (95 per cent.).

There are two classifications as to the origin of the appendicular artery, viz.: I., an old anatomic classification of denoting its origin from (1) the ileo-colic artery (36 per cent.); (2) from the dorsal ileocecal (28 per cent.);

CONCENTRIC GASTRIC CIRCLES. COELIAC AXIS. ARTERIAE EPIPLOICAE.

Fig. 60. This illustration presents the usual form of the coeliac axis, i. e., a bifurcation, not a trifurcation. This subject was an infant hence the enormous dimension of the liver and hepatic artery.

Note the distinct omental vascular arches or circles:

GT, proximal gastric circle; GD, gastro epiploica (dextra); GES, gastro epiploica (sinistra); PD, pancreatico-duodenalis (duodenal circle); Co. Coeliac axis; D, diaphragmatic arteries; OE, oesophagus; VB, vasa brevia; H, arteria hepatica communis.

(3) from the ventral ileo-cecal (11 per cent.); (4) from the mesenteric (24 per cent.) These percentages are from our personal dissections in 65 subjects. II, Byron Robinson's classification, which consists of denoting the origin of the appendicular artery from the "ileo-colic circle" (96 per cent.) or "ileo-colic arches" (95 per cent.) The simplicity of the latter classification of the origin of the appendicular artery is amply evident when one views the ileo-colic circle and ileo-colic arches as primordial vascular landmarks.

The ileal artery is emitted to nourish the ileum, and the ileo-colic artery is emitted to nourish the cecum and appendix (a primordial herbivorous stomach). The ileo-colic and ileal arteries (arising from the bifurcation of the jejunal artery) inosculate at their distal ends—forming the "ileo-colic circle." The ileo-colic artery forms the right circumference, and the ileal artery forms the left circumference of the ileo-colic circle. The ileo-colic artery bifurcates into the dorsal ileo-cecal artery and ventral ileo-cecal artery, which by their combined anastomoses form the ileo-colic arches. Hence the appendicular artery originates from the "ileo-colic circle" (96 per cent.) or the ileo-colic arches (95 per cent.).

According to our 65 dissections if there were but one appendicular artery it mainly emited a branch to (1), the appendix; (2), to the dorsal coecal wall; (3), to the coeco-appendicular angle; (4), to the ileocoecal fold. In subjects comparatively fleshy the best method to discover the appendicular artery during removal of the appendix for perityphlitis is to divide the mesoappendix whence the spouting blood column will locate it.

Remarks. The ileocolic artery assumes increased significance when it is considered, first, that its origin is at the junction of the jejunal artery and the ileal artery, i. e., it divides, marks the jejunal artery from the ileal artery, second that the ileocolic artery forms the right circumference of the "ileocolic circle," third, that it is the primary origin of the chief appendicular artery; fourth, that the terminal portion originates the "ileocolic arches" which is the secondary origin of the chief appendicular artery; fifth, that the ileocolic artery posses a "straight terminal vessel" of ample length for ligation or clamping without compromising the "ileocolic circle." The trunk of the ileocolic artery is immortalized as being the source of the main appendicular artery (51 per cent.), and its branches—ramus iliacus (45 per cent.), ramus ileocoecolis (95 per cent.), ramus colicus (3 per cent.), originates the remainder. The ileocolic artery may arise as a common trunk with the arteria colica dextra. The ileocolic artery may present duplicity, see figure (33).

The appendicular artery, a minimum artery, is significant, as it nourishes the dangerous and treacherous atrophic appendix—dangerous because perityphlitis kills and treacherous because its capricious course cannot be prognosed. The atrophying appendix is supplied by arteries of limited number (two) and calibre. The arteria appendicularis primarily and in the majority of subjects originates directly from the right circumference of the ileo-colic circle; *i. e.*, from the ileo-colic artery (96 per cent.). The appendicular artery secondarily and in the minority of subjects originates directly from the ileo-colic arches (95 per cent.) *i. e.*, from the arteria ileo-cecalis dorsalis et ventralis. The appendicular artery arises primarily from the ileo-colic circle, and secondarily from the ileo-colic arches. The number of branches of the appendicular artery averages twelve. The appendicular artery originates two and one-half times as frequently from the dorsal ileo-cecalis as from the ventral ileo-cecalis. The general etiology of perityphlitis is trauma of the psoas muscle, producing peri-typhlitic peritoneal adhesions which by contraction compromise the appendicular vessel, especially in the meso-appendix, and flex the appendix, thereby checking drainage—ending in perforation. The average number of appendicular arteries for each individual is two.

COELIAC AXIS. CONCENTRIC GASTRIC CIRCLES. ARTERIAE EPIPLOICAE.

Fig. 61. Specimen of my personal dissection from middle aged male. This illustration presents the "concentric gastric circles" in situ (in black). The gastro-epiploic artery has its right origin in the hepatic (I discard the term gastro-duodenal artery) while the left origin is in the splenic artery. From the gastro-epiploic artery emerges the arteriae epiploicae—some dozen long, slender, spiral vessels.

Note the vascular omental circles, loops, arches.

The omentum from its rich vascularization is the "policeman of the belly" protecting points of infection in invasion by building, rapidly, barriers of exudation to imprison germs, to sterilize germs, to digest them by leucocytes.

The ileo-colic circle may possess, imposed on its periphery, a series of minor vascular arches (Figs. 24, 32). It is a primordial vascular landmark destined to nourish the ileum and cecum, with the appendix as an ancient stomach.

The ileocolic arches are a primordial vascular landmark of the cecum and atrophying appendix. They resemble the meso-sigmoid arches or other arches located in the flexures of the tractus intestinalis. At each colonic flexure (ileo-colic, hepatic, splenic, sigmoid) there may be an accumulation, a condensation, of vascular arches. The ileo-colic arches are located in the ileo-colic angle. The clinical signification of these arches is included in their relation to surgical procedures of the cecum and appendix. They may be clamped or ligated without molesting the ileo-colic circle. The ileo-colic arches are mainly associated with the appendicular blood supply, secondarily and directly originating one or more appendicular arteries. Practically these arches—though connected by anastomosis with the colic and ileal arteries—appear as quite independent, isolated structures, destined for the cecum.

Data of the Appendicular Artery Ileo-Colic Circle, and Number of Ileo-Circle Arches in Sixty Personal Dissections.

I. *Old Classification of the Origin of the Appendicular Artery.*

Number of subjects—65.

Average number of appendicular arteries for each individual—2.

Origin of appendicular arteries—ileo-colic artery (36 per cent.), dorsal-ileo-cecal artery (28 per cent.), ventral ileo-cecal artery (11 per cent.), mesenteric artery (24 per cent.)

Number of branches to appendix—12.

Number of ileo-colic arches—6.

II. *Byron Robinson's Classification of the Origin of the Appendicular Artery.*

The ileo-colic circle and ileo-colic arches are the standards. Number of subjects—65.

Average number of appendicular arteries for each individual—2.

Origin of appendicular arteries—ileo-colic circle (96 per cent.); dorsal ileo-cecal artery (70 per cent.), ventral ileo-cecal artery (25 per cent.), a total for ileo-colic arches of (95 per cent.).

Number of branches to appendix—12.

Number of ileo-colic arches—6.

With a knowledge of the limited blood supply to the appendix of meso-appendicular adhesions with consequent progressive peritoneal contraction due to psoas trauma, the frequent attacks of peri-typhlitis became better understood. Anyone who performs a large number of abdominal autopsies becomes aware that peri-typhilitis as well as meso-sigmoiditis—80 per cent.—(both due to psoas trauma) is a common chronic disease, and acute (perforative) peri-typhlitis is mainly an exacerbation of chronic peri-typhlitis.

By reference to Table I it is evident that the classification of the orgin of the appendicular artery is not only complicated but uncertain. The so-called mesenteric artery is uncertain and possesses no recognized standard. Table II. presents my own classification of the origin of the appendicular artery, i. e., the appendicular artery arises either from the ileo-colic circle (96 per cent.). or from the ileo-colic arches (95 per cent.). Since this artery arises from either source, its simple percentage could not be 96 per cent. and 95 per cent. But it is not a simple percentage, for frequently the arteries vary in number and origin. Should there be several appendicular arteries, the greater number of the several will originate from the ileo-colic arches.

For example, two appendicular arteries may arise from the ileo-colic circle and none from the ileo-colic arches, and *vice versa*. Three appendicular arteries

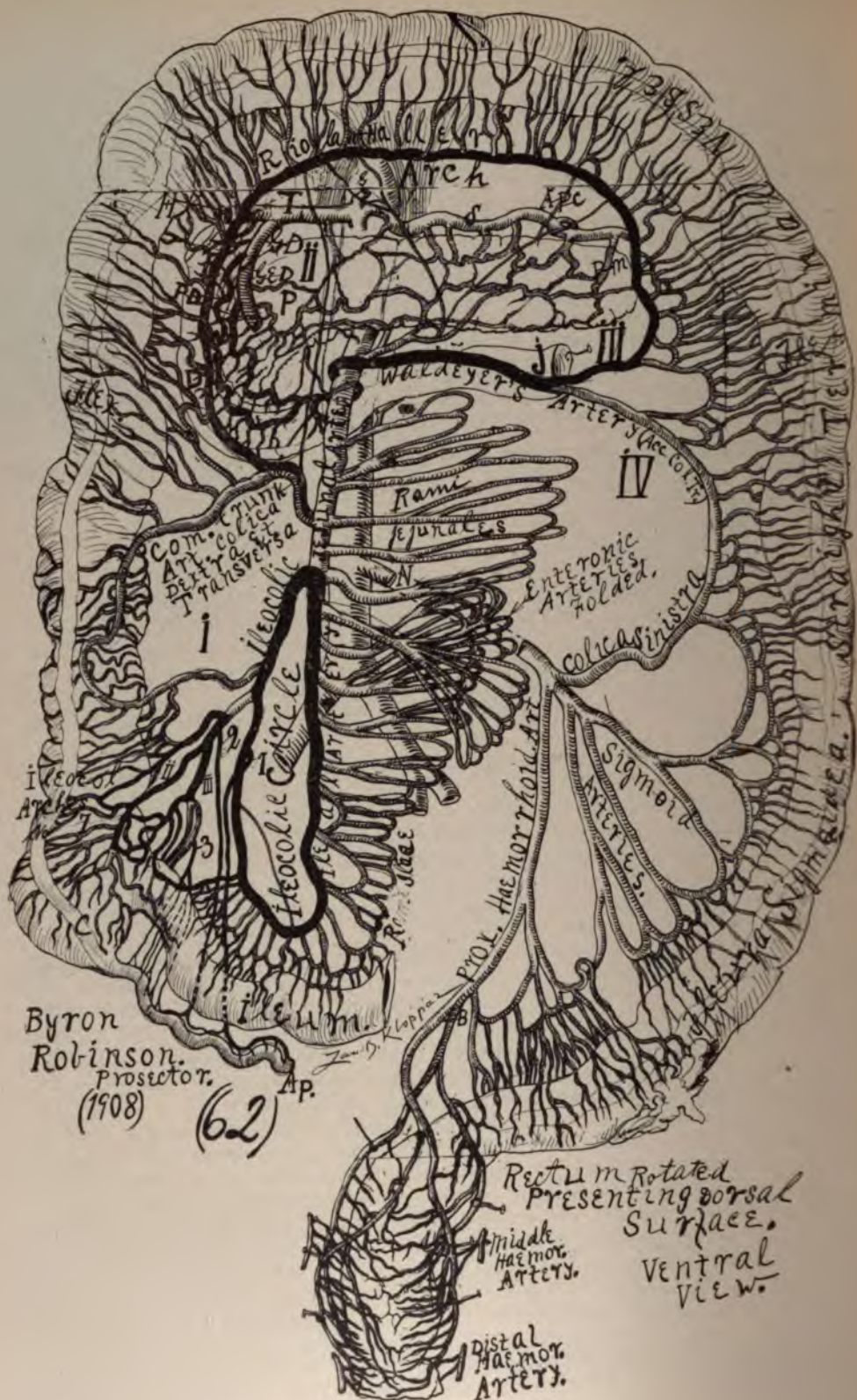

Rectum Rotated Presenting Dorsal Surface.
Ventral View.
Middle Haemor. Artery.
Distal Haemor. Artery.
Byron Robinson. Prosector. (1908)
(62)

Fig. 62. My personal dissection. Ventral view.

"Ileocolic circle;" "ileocolic arches;" enterocolic circle (Riolan-Haller arch, arcus mesocolicus); all in black. "Straight terminal vessel" amply evident. "Duodenal circle" (in black) composed of the arteria pancreaticoduodenalis (proximal and distal) and the rich anastomotic apparatus (arcus pancreaticus, "pancreatic circle"), are evident. Note the abundant vessels at the colonic flexures. The enteronic arteries are folded in the center to save space.

Pancreatico-colic and omental artery (A.P.C.). The arterial fields or major mesocolic circles are marked. The pancreatico duodenal artery (proximal and distal forms an oval loop in its center which I term the "circle of the pancreatico-duodenal artery." The entero-colic-circle would be a giant circle except that it is interrupted by a Waldeyer artery. The rectal supply is rich.

1, Appendicular artery (primary vessel), a vessel of moderate caliber, arises from the "ileocolic circle" (i. e., the ileocolic artery) and supplies the free half of the appendix. 2, appendicular artery (secondary vessel), a vessel of diminutive caliber arises from the "ileo-colic arches" (i. e., from both dorsal and ventral ileocecal) and supplies the middle portion of the appendix. 3, appendicular artery (tertiary vessel), a vesssel of medium caliber arises from the "ileocolic arches" (i. e., from the dorsal ileocecal artery). The three appendicular arteries emit 17 branches to the appendix.

The "ileocolic circle" sinuous in contour originated on the main appendicular artery. It is of oval form 6 x1½ inches.

The "ileocolic arches," 3 in number are irregular in form, dimension and in the caliber of the anastomosing vessels. The ileocolic arches in Fig. (62) do not appear as independent structures or an isolated apparatus, however, the lateral colic and ileal anastomosis is limited.

The "straight terminal vessel" is evident in Fig. (62). On the right colon a mesocolic arch lies on its ventral surface, however, blunt dissection will free the "straight vessel" with facility allowing ample length for ligation or clamp. If the right colon and arch be seized and drawn the "straight vessel" will be apparent.

The ileal artery extending from the origin of the ileocolic artery to the anastomosis with the ileocolic emits 22 branches to the ileum. The caliber of the rami elei gradually decreases toward the cecum and at the distal ileum the caliber is diminutive. In fact, so limited is the blood volume to the distal ileum that disease is rampant.

The jejunal artery, extending from its origin in the aorta dorsal to the pancreas to its bifurcation into ileocolic and ileal arteries, emits six rami jejunalis of maximum caliber and conducting a maximum volume of blood. The blood volume of the eight feet of jejunum is of such maximum quantity that the jejunum is but rarely diseased.

may arise from the ileo-colic arches and none from the ileo-colic circle. The confusion arises from the fact that practically each individual possesses two appendicular arteries.

The appendix is the safer not with numerous small arteries, for the meso-appendicitis compromises them by contraction of the adhesions with facility, but the appendix with a single large artery which, from dimension and strength is difficult to compromise by contracting peritoneal adhesions in the meso-appendix. Repeated injections in subjects afflicted with meso-appendicitis (mesoperityphlitis) repeatedly demonstrated that the meso-appendicitis had compromised it. Meso-appendicular vessels—the more advanced the meso-appendicitis the more compromised were the meso-appendicular vessels.

The main causes of peri-typhlitis are: (1) Trauma of the psoas muscle, inducing germs or their products to pass from the tractus intestinalis into the meso-appendix, ending in (2) meso-appendicitis (meso-perityphlitis,) which results in compromising the meso-appendicular blood vessels and flexing the appendix; thereby checking appendicular drainage and ending in perforative perityphlitis. Perforative perti-typhlitis possesses in general a chronic pre-peri-typhlitic stage (a pre-appendicular course).

Anomalies of the Ileocolic Artery.

There were but slight variations in the ileocolic artery in 65 consecutive dissections.

Location, number, dimension (length and diameter) course and relations are fairly constant.

COELIAC AXIS. CONCENTRIC GASTRIC CIRCLES. ARTERIAE EPIPLOICAE. ENTERO-COLIC CIRCLE (R-H, ARC).

Fig. 63. A personal dissection.

This illustration presents the bifurcating coeliac axis. It presents the "circle of the gastric artery." It presents a typical "inosculation circle" in the omentum majus. Also the

location of the "entero-colic circle" (R-H, ARC) is noted D-C, Ductus choledochus communis and D-H. Ductus hepaticus with relations to blood vessels.

In this illustration the omentum majus, the "Policeman of the belly" is extremely vascular.

The ileocolic artery presented duplicity once in figure (33). It arose as a common trunk with the colica dextra in 30 per cent. of subjects.

The length of the ileocolic trunk varies on account of the varying point at which the ramus colicus emerges.

Anomalies of the Proximal Mesenteric Artery Occurring in Our Sixty-Five Consecutive Dissections.

The proximal mesenteric artery arose practically in common with the arteria celiaca (Figure 53). It emitted the right renal artery (Figure 43). It emitted a branch to the liver (Figures 36, 53). It emitted a branch to the arteria celiaca (Figures 38, 41, 40, 43, 50, 51). It emitted a branch to the distal mesenteric artery (Figure 59).

Topography.

(a) *Holotopia* (relation to general body). The proximal mesenteric artery is located, unpaired, in the medial portion of the abdominal cavity. Though it be an unpaired artery it practically possesses bilateral branches.

(b) *Skeletopia* (relation to the osseous system). Skeletopically it is located ventrally and mainly parallel to the lumbar vertebrae and sacrum.

(c) *Syntopia* (relation to adjacent viscera). The distal mesenteric artery is intimately associated with the peritoneum and its adjacent lymphatics. It is directly connected with and supplies the enteron (except the duodenum), the appendix, cecum, right colon, and half of the transverse colon. It is intimately associated with its corresponding veins on the right side, and its branches are especially related to the right kidney and ureter. Its distal termination is associated with the female genitals.

(d) *Idiotopia* (relation of its component parts). It consists of trunk, branches, arches, and straight terminal vessel.

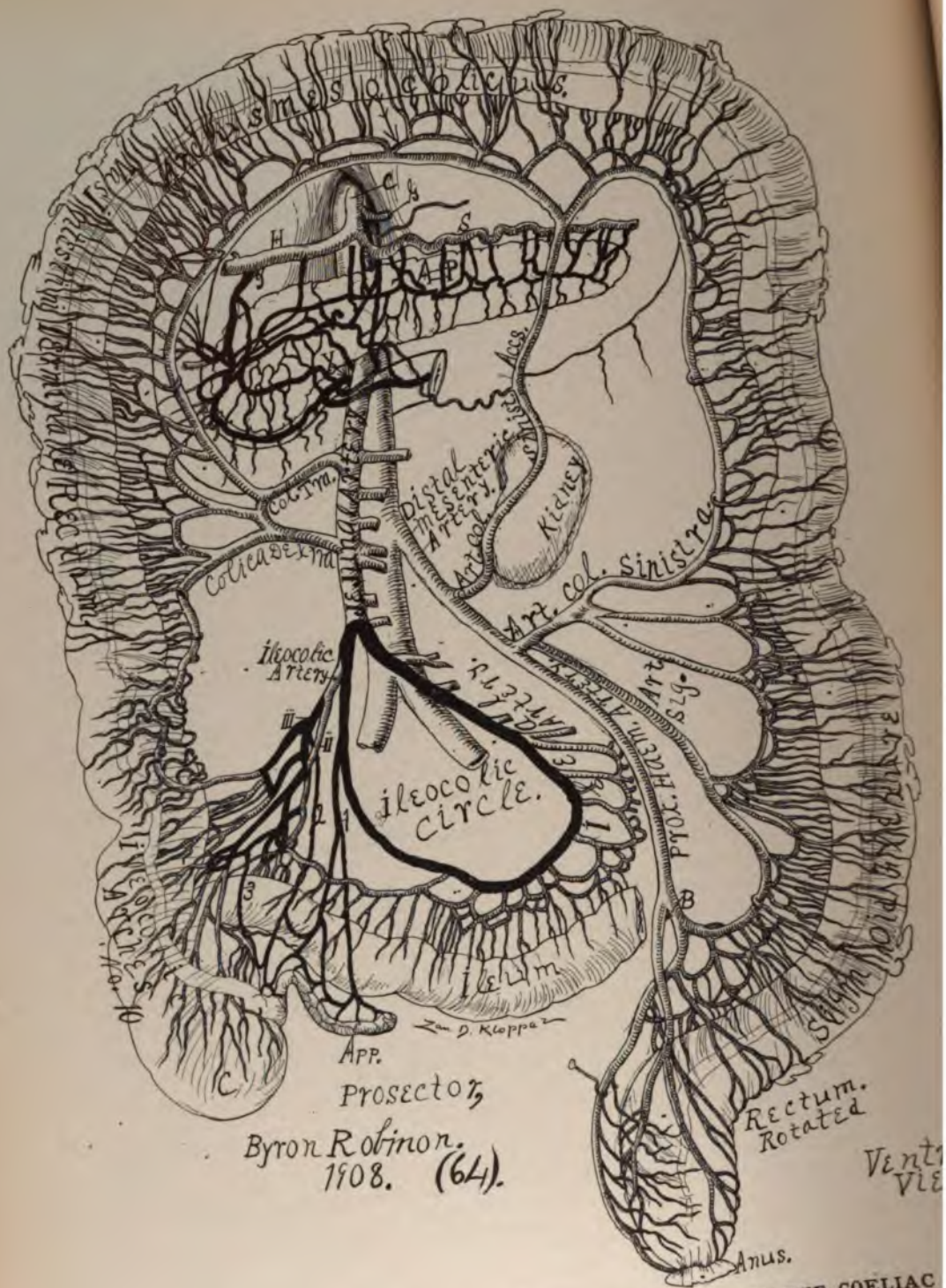
Conclusions Regarding the Proximal Mesenteric Artery.

I. Anatomic.

The proximal mesenteric artery consists of I., jejunal and Ileal arteries; II., branches; III., arches; IV., straight terminal vessel.

The jejunal artery averages one-third of an inch in diameter and three inches in length. Syntopically, the origin of the jejunal artery is dorsal to the pancreas, and its ending is the region of the origin of the arteria mesenterica distal. The jejunal artery extends from the celiac axis to the origin of the distal mesenteric artery. Skeletopically, it begins at the junction of the first and second and ends at the junction of the third and fourth lumbar vertebrae. The jejunal artery possesses a condition known as volvulus. The spirality of the proximal mesenteric artery is evident from the emergence of its branches from its entire circumference.

The jejunal artery plus the ileal artery possesses a peculiar leftward curve which is very slight in the living or noninjected artery. The marked leftward curve found in the proximal mesenteric artery is chiefly due to the fact that its proximal end, root, is fixed, and its distal end, periphery, is fixed at the symphysis sacroiliaca. Hence during injection the proximal mesenteric artery assumes a curve in the direction of least resistance, which is leftward. The dragging leftward of the enteronic coils after the abdominal viscera are exposed by a peritoneal incision enhances the leftward convexity and rightward concavity of the proximal mesenteric artery.



THE PROXIMAL AND DISTAL MESENTERIC ARTERIES WITH THE COELIAC

Fig. 64. From my personal dissection.

This illustration presents important "inosculation circles" or vascular landmarks, viz.: Ileocolic circle, Ileocolic arches, Enterocolic circle, Duodenal circle, Pancreatic circle, major mesocolic circles. It presents 3 appendicular arteries which inosculate, forming meso-appendicular arches, resembling mesenteronic arches. The "straight terminal vessel" is amply evident. Note the mesocolic arch resting on the ventral surface of the right colon. Observe that practically a Waldeyer artery arises from the distal mesenteric artery and it interrupts the giant entero-colic circle or Riolan-Haller arch. A distinct circle exists in the arteria pancreatico duodenalis (proximal and distal).

Attention may be directed to the fact that the gastric artery (G) is directly united to the pancreatico-duodenal artery (distal).

The most significant factor in the course of the proximal mesenteric artery is that it passes perpendicularly over the ventral surface of the distal transverse duodenum, and during the progress of splanchnoptosia compresses and obstructs the duodenum, resulting in gastroduodenal dilatation, which is a phase of sphlanchnoptosia.

The proximal end of the proximal mesenteric artery—the jejunal artery— is associated with the dorsum of the pancreas, while the distal end of the jejunal artery bifurcates to form the "ileocolic circle"—a constant structure with a constant location. The "ileocolic circle" is completed by the inosculation of the distal ends of the ileocolic artery and the ileal artery. The bifurcation of the jejunal artery produces the, ileocolic artery which supplies the cecum and proximal part of the right colon, and the ileal artery, which suppiles the ileum (with perhaps a dozen branches).

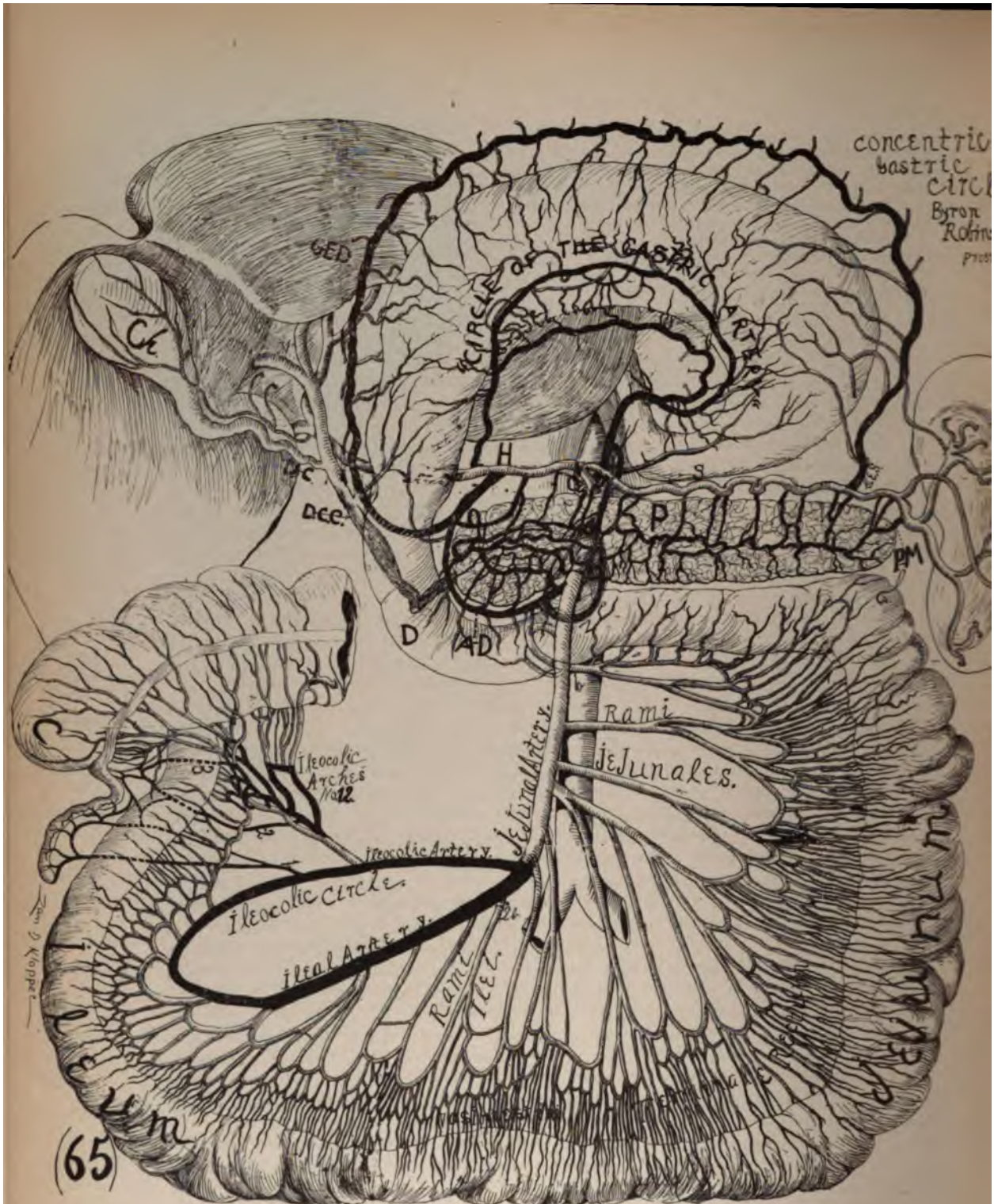
The divisions of the proximal mesenteric artery in the mesenteron and meso-colon into: (a) the zone of the trunks; (b) the zone of the branches; (c) the zone of the arches; (d) the zone of the "straight terminal vessel" will facilitate the comprehension of its topography.

The enteronic arteries average twenty-one for each individual and consist of trunks, arches, branches, and "straight terminal vessel."

(a) The *trunks* of the rami ilei occupy three inches of the mesenteron. The arches occupy two inches of the mesenteron. The "straight terminal vessel" occupies one inch of the mesenteron. The trunks of the rami ilei are of less dimension (length and diameter) than those of the rami jejunales. The mesenteronic arches of the ileum occupy proportionately greater space, while the "straight terminal vessel" resembles that of the jejunum. The form of the mesenteron of the ileum is that of a triangle, with the apex at the distal end of the ileum. There may be six enteronic zones of arches. The average number of arches in twenty subjects (in primary mesenteronic zone) was twenty-two, the secondary was thirty-two, the tertiary was eighteen, the quartenary was five, the quinary was four-fifths, and the sexternary was one-twentieth. The curved mesenteronic zone of arches diminishes in width, but increases in length, from the proximal mesenteric artery to the enteron. The enteronic branches of the proximal mesenteric artery supply the doudenum (arteria doudenalis distal) and anastomose with the arteria doudenalis proximal. The arteriæ duodeni constitute the arcus duodenalis and with the arcus pancreaticus compose the arcus gastricus, which solidly and compactly anastomoses the viscera of the celiac axis with the viscera of the proximal mesenteric artery.

(b) The *branches* of the jejunum (rami jejunales) arise from the trunk of the jejunal artery (a full half-dozen) and supply the jejunum with colossal blood volume.

(c) The *branches* to the ileum (rami ilei) arise from the ileal artery (a dozen and a quarter) and supply the ileum. The ileal artery is the left bifurcating arm of the jejunal artery. Note that the distal ileum possesses minimum blood supply of any segment of the tractus intestinalis (except that of the appendix), hence its minimum vitality, and consequent victim of typhoid ulceration, tuberculosis, ulceration.



THE COELIAC AXIS AND PROXIMAL MESENTERIC ARTERY.

Fig. 65 from my personal dissection. Proximal and Distal "Concentric Gastric Circle." This illustration presents the "concentric gastric circles," composed of the gastric and gastro-epiploic arteries reflected (in black). In this subject the gastric artery presents what I term the "circle of the gastric artery." The gastro-epiplocia extra begins in the hepatic, and the

left end terminates in the splenic artery. Observe the "duodenal circle" (arcus duodenalis) plus the "pancreatic circle" (arcus pancreaticus) solidly and compactly anatomoses the coeliac axis to the jejunal artery. Both pancreatic and duodenal circles are in black.

The mesenteric arteries (rami jejunales—6—et rami ilei—10) are expanded on a plane and sketched.

The appendicular arteries No. 1, aries from the ileocolic circle (ramus iliacus). No. 2, aries from the ileocolic arches. No. 3, aries from the ileocolic ircles. The "inosculation circle" is well represented. Its function is to congest its peripheral viscus.

II. Applied Physiology of the Arteries of the Enteron.

(a) The enteron is the significant business portion of the tractus intestinalis and function (sensation, peristalsis, absorption, and secretion) may be observed at its maximum in it approximately following each meal, we drink from the enteron, the fountain from which the body collects its fluids.

(b) The arteries of the enteron, vas intestini tenuis, experience periodically enormous changes in the blood volume in times of active digestion similar to the uterus during gestation. The rami jejunales et rami ilei experience more frequent, profound periodic congestion than any arteries. The physiology of the enteronic arteries is sensation, peristalsis, absorption, secretion. The initiater, sustainer, subsider of their function, physiology, is blood. Their object is to conduct blood to the enteron.

The *enteron* is the chief functionating or business portion of the tractus intestinalis and requires an enormous blood supply; hence it receives the major branches of the proximal mesenteric artery.

The *cecum* (and the appendix—a once maximum herbivorous stomach) required a large blood volume, hence it receives a powerful blood supply from the constant major branch—the ileocolic artery. The vas intestini tenuis or enteronic arteries conduct, during the functionation of the enteron, an enormous quantity of blood from shere number (twenty-one) and magnitude of vessels (one-half dozen one-eighth inch in diameter for the jejunum) (and a dozen and a quarter for the ileum of vessels. The ponderous volume of blood conducted by the rami jejunales not only enables the jejunum to digest the vast majority of food, but the abundant blood volume is a prophylactic against jejunal disease, as typhoid fever, tuberculosis, or ulceration, that usually attack the ileum, which is supplied by vastly less volume of blood than the jejunum.

(c) The spirality or the torsioned state of the proximal mesenteric artery is evident from the emergence of its branches from the four great quarters of its circumference, namely: arteria duodeni from the right and dorsal surface, rami jejunales and rami ilei from the left border, ileocolica and colica dextra from its right and ventral borders, pancreaticoduodenalis distal and occasionally a proximal ramus jejunalis from its dorsal border. The chief spirality of the proximal mesenteric artery mainly involves its proximal half, i. e. for example the jejunal artery as the first or proximal rami jejunales arises from the dorsal surface, and the last or distal rami jejunales arises to mark the ventral surface of the jejunal artery. The spirality of the proximal mesenteric artery depends on the embryonic rotation of the tractus intestinalis, on the length of the mesenteron, that is, on the forced position of the enteronic coils and colonic segments.

The proximal mesenteric artery supplies the primitive mid-segment of the intestine i. e., from the entrance of the biliary and pancreatic ducts to the splenic flexure, i. e., the duodenum, enteron, right colon, transverse colon are involved in absorption. They are the drinking or absorbing fountains of the body. Fluids and solids are mainly absorbed from the enteron—the periphery of the proximal mesenteric artery—maximum blood supply. (The colon—the primitive distal intestinal segment beginning at the splenic flexure is a secreting organ, with storage function, a reservoir—located on the periphery

of the distal mesenteric artery—a minimum blood supply). It is amply evident in studying embryology that function precedes structure and that function is more permanent than form. Morphologically the field of the proximal mesenteric artery begins at the pylorus and ends at the ileocolic valve, however, the real function begins in the duodenum at the entrance of the pancreatico—biliary ducts and ends at the splenic flexure as the function of absorption extends to the junction—anastomosis of the proximal and distal mesenteric artery. To the periphery of the distal mesenteric artery i. e. the left colon, sigmoid and rectum belongs the function of secretion a feacal resevoir. Function is the significant matter within the periphery of the proximal mesenteric artery because it is the segment of absorption—of digestion. The periphery of the proximal mesenteric artery supplies blood to the organs, maintains the most dignified physiologic position in digestion; viz: the pancreas (liver) and the enteronic. Since blood cures disease, and is a prophylactic against disease the drinking or absorbing fountain of digestion should be supplied with healthy fluid and food as well as normal removal of secretions from the reservoir.

III.—Applied Pathology of the Proximal Mesenteric Artery.

Pathologically, the most significant factor relating to the proximal mesenteric artery is its compression of the distal transverse duodenum during the progress of splanchnoptosia. The jejunal artery is noteworthy from the following factors:

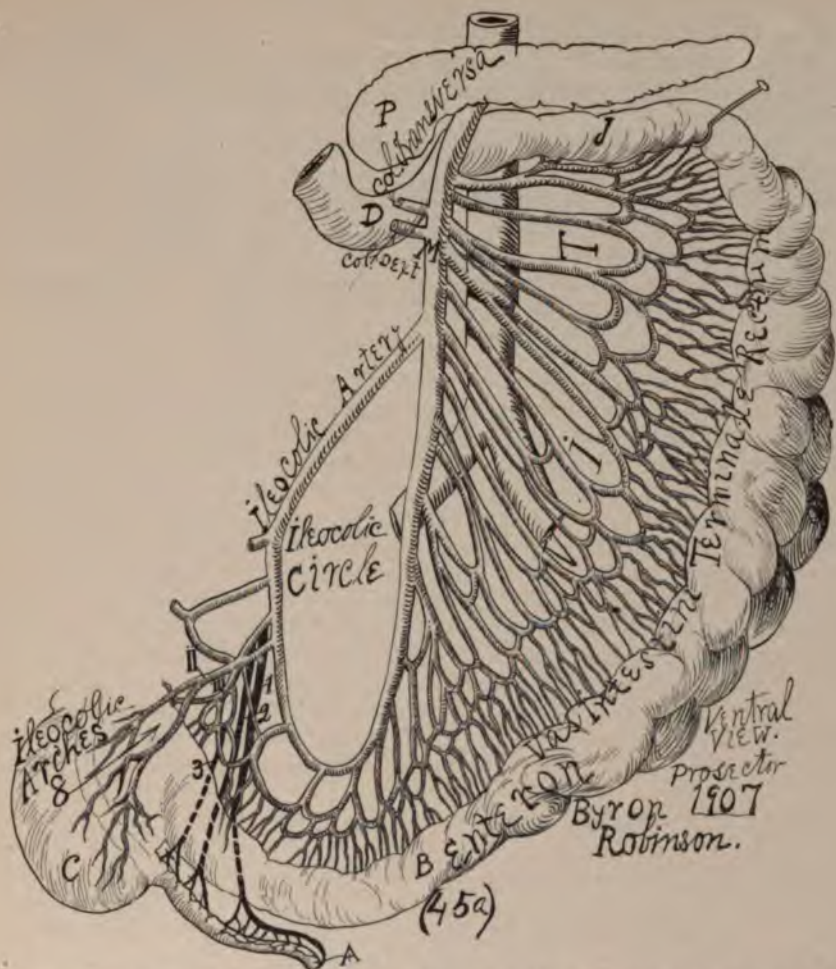
(1) The most important matter in regard to the jejunal artery (proximal mesenteric artery) is its relation to gastroduodenal dilation. It courses ventral to the distal transverse duodenum. In other words, the duodenum lies in the bifurcation of the aorta and proximal mesenteric artery—in the aorto-mesenteric angle, aorta jejunal angle. Since the duodenum is practically fixed, immobile, it cannot pass distalward while the viscera which the proximal mesenteric artery supplies (enteron, except duodenum, cecum, right colon and half transverse colon) may pass distalward with facility, into the pelvis elongating the artery. The passing distalward (especially that of the enteron) into the pelvis (of the viscera supplied by the proximal mesenteric artery), diminishes the aorto-mesenteric angle, in which the duodenum lies, and consequently progressively clamps and obstructs the duodenum, producing gastro-duodenal dilatation.

*Gastroduodenal Dilation.**

Gastroduodenal dilatation is a definite step in progressive splanchnoptosia. It is a slow, gradual process. Acute gastroduodenal dilatation is simply exacerbation of a chronic process. Gastroduodenal dilatation is a part and parcel of splanchnoptosia, which is a frequent disease and one of the most important of modern recognition. It was first systematically described by Doctor Frantz Glenard, a French physician, in 1884, hence the pathologic eponym, "Glenard's disease." Splanchnoptosia involves the field of doubtful surgery. It includes the subject of visceropexy or visceral fixation, that is, the substitution of an alleged excessively mobile viscus for a fixed one. Visceropexy is the substitution of one pathologic condition for another.

The jejunal artery or trunk of the proximal mesenteric artery involves the field of splanchnoptosia to an extensive degree. The elongation (splanchnoptosia) of the proximal mesenteric artery diminishes its lumen (consequently diminishes blood transportation), it diminishes the diameter of the vascular parietes (consequently diminishes effective peristalsis). It traumatizes its sursurrounding sheath of nerves (consequently initiating a neurosis). Splanchnoptosia distorts, vitiates the physiology or function of viscera (sensation, peristalsis, absorption, and secretion), ending in malnutrition, neurosis.

*(See Byron Robinson's book, "Abdominal and Pelvic Brain," with "Automatic Visceral Ganglia.") Published by Frank Betz & Co., Hammond, Indiana.



JEJUNAL ARTERY (WITH ITS 6 RAMI-ILEI) ILEAL ARTERY (WITH ITS 12 RAMI JEJUNALES). ILEOCOLIC CIRCLE. ILEOCOLIC ARCHES (NO. 8). STRAIGHT TERMINAL VESSEL.

Fig. 66. This illustration presents typically the mesenteronic arteries in relations, dimensions, form, number.
Observe the manner the jejunal artery clamps the duodenum.

The important pathologic factors in regard to the proximal mesenteric artery are:

(1) Compression and obstruction of the transverse duodenum during splanchnoptosia, producing gastroduodenal dilatation.

(2) During splanchnoptosia: (a) the lumen of the artery is compromised, diminishing the volume of blood to the intestines; (b) the vascular parietes are atrophied, extended, rendering persistalsis defective; (c) the nervus vasomotorius accompanying the artery interwoven into its vascular fibrous sheath is traumatized, extended, rendering defective the functions of the arteries (secretion, peristalsis, absorption, sensation); (d) the lymphatics are traumatized, elongated with compromised lumen. The end result is neurosis and malnutrition with gastro-duodenal dilatation.

(3) The proximal mesenteric artery is subject to embolus. A typical sub-

ject of embolus occurred in the left side of the ileocolic circle (in Figure 17 at x). However, the anastomosis is so solid and compact that collateral circulation maintained practically normal nutrition, as no lesions adjacent to the embolus could be observed.

(4) The vessel is subject to arterial sclerosis, which compromises the lumen (diminishing blood transportation), hypertrophies the parietes (compromising function—sensation, peristalsis, absorption, secretion), damages the nerves with the nerves sheaths, compromises the accompanying lymphatics, resulting in neurosis and malnutrition.

(5) The proximal mesenteric artery possesses a spiral state and hence perchance aids in volvulus of the enteron.

CHAPTER III.

THE DISTAL MESENTERIC ARTERY.

Inferior Mesenteric Artery.

(*Arteria Mesenterica Distal.*)

Dissection.—Expose the viscera by a crucial abnominal incision, reflect the enteron rightward, and the transverse colon proximalward. Draw the left colon and sigmoid leftward. Remove the distal transverse mesocolic blade, the right mescolic blade of the left colon and right mesosigmoid and the main parts of the distal mesenteric artery will be exposed.

The description of the distal mesenteric artery varies more than that of any other artery—suggesting its various form. The reason for the multiple variation in description of the distal mesenteric artery lies perhaps, first, in the multiple, though frequently insignificant variation of form and number in its branches and arches. Second in the limited number of subjects dissected and observed by single individual writers. Third, in an attempt to compare single dissections with some of the few popular standard illustrations, the view may be acquired that there are numerous types or variations.

In general the arteria mesenterica distal (inferior) should be described as consisting of the following segments:

I. Trunk.

II. Branches: 1. Left colic artery. 2. Sigmoid artery. 3. Proximal hemorrhoidal artery.

III. Arches: (a) left colic arches; (b) sigmoid arches; (c) proximal hemorrhoidal arches.

IV. "Straight terminal vessel" of the distal mesenteric artery.

GENERAL REMARKS.

Topography.—Holotopia.—It is nonsymmetrically located in the median left half of the body. It is an unpaired artery.

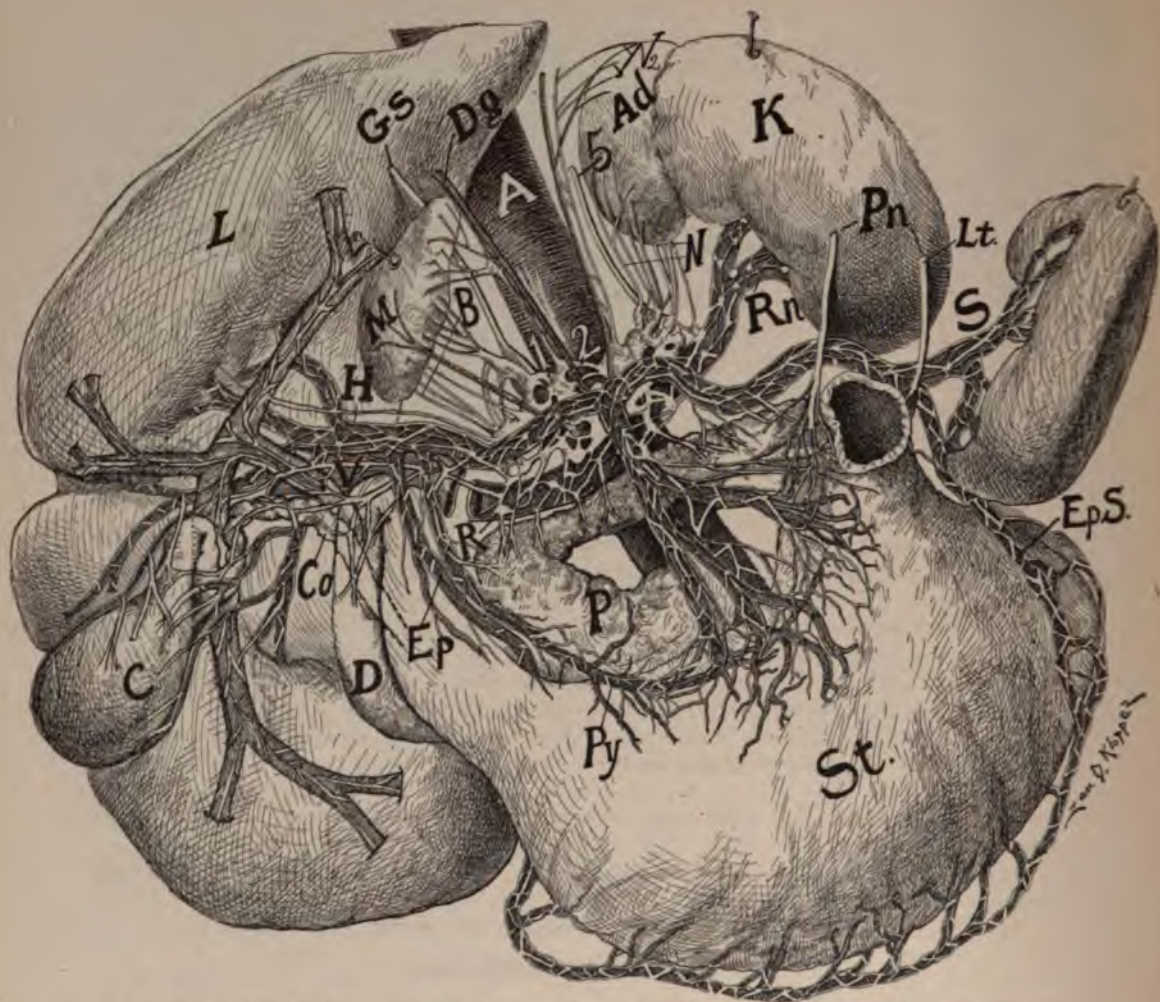
Skeletopia.—It is situated leftward of the vertebral column, between the ribs and coccyx.

Syntopia.—It supplies the distal half of the colon—left half of transverse colon, left colon, sigmoid and rectum. It is the artery of the fecal reservoir. It supplies the apparatus of foecal storage. It supplies the secretive segment of the colon. It is intimately associated with the peritoneum ventrally and dorsally with the musculature of the dorsum. It lies ventral to and in contact with the distal aorta, vasa spermatica (ovarica) kidney, ureter left common iliac. It is imbedded in a strong sheath of connective tissue and in the membrana mesenterii propria.

Idiotopia.—The relations of the component parts are arranged practically in the form of trunk, arches, straight vessels, located at a greater or lesser distance from the colonic border.

The entire body may be injected through the distal mesenteric artery. The varied forms of the distal mesenteric artery has induced varied types of descriptions. I shall assume from the study of the anatomy, literature, three types of description:

Type A includes those anatomists who divide the common primary trunk of



THE COELIAC AXIS WITH THE NERVOUS VASOMOTORIUS ENSHEATHING ITS BRANCHES.

Fig. 67. This illustration represents the coeliac axis surrounded by the abdominal brain (Plexus coeliacus). The coeliac branches (hepatic, splenic and gastric arteries) are ensheathed by a gangalionated membranous fenestrated fibro-nervous cylinder which controls the functions of the artery (sensation, peristalsis, absorption, secretion) and consequently the blood volume to the liver.

The abdominal brain ensheathing the coeliac axis with its radiating nervous sheaths on the hepatic, splenic and gastric arteries forces the stomach and duodenum with its giant adjacent glands (liver, pancreas and spleen) to act practically as a unit in function (sensation, secretion, absorption, persistalsis).

the distal mesenteric artery in two branches, i. e., it bifurcates, viz.: arteria colica sinistra (ramus proximal) and arteria hemorrhoidalis (ramus distal) (see Figs. 30, 42, 26, 23, 35, 25, 37, 28, 32, 38).

I shall designate the primary branches of the common trunk of the distal mesenteric artery as: (a) ramus proximal (arteria colic sinistra); (b) ramus medial (arteria sigmoidia); (c) ramus distal (arteria hemorrhoidalis proximal). This makes the common trunk bifurcate in 70% and trifurcate in 30 of our personal dissections. In this type may be found Tiedeman (1822), Cloquet

(1828), Meckel (1832), Bourgery and Jacob (1839), Cruvelihier (1844), F. Arnold (1847), Luschka (1863), Chr. Aeby (1871), L. Hollstein (1873), Harrison Allen (1873), Henle (1876), Rudinger (1878), W. Kraus (1879), C. Bock (1880), R. Hartman (1881), Joessal (1884), Hyrtl (1885), Ad. Pansch (1885), Gegenbaur (1888), Henry Morris (1893), Testut (1895), Spalteholtz (1898), G. Broesike (1899), Toldt (1900), Gray (1905). The above are mostly German anatomists. Nations possess convictions and imitate each other. In 70% of our subjects the truncus communis arteria mesenterica distal was divided in two branches—it bifurcated.

Type B represents those anatomists who describe the trunk of the distal mesenteric artery as emitting three distinct primary independent branches—the trunk trifurcates (see Figs. 36, 39, 40, 41, 43, 44, 47). In this type (B) may be found Andrew Fyfe compend of anatomy (1823), Bourgery and Jacobs (1839), Erasmus Wilson (1842), Alfred von Behr (1847), the Dublin Dissector (1848), Harrison Allen (1883), Quian (1892), Morris (1892), McClellan (1892), Spalteholtz (1898), Rauber (1903), Cunningham (1905).

The above authors represent chiefiy English anatomic views and even anatomists assume distinct national airs. Frederic Tiedeman, the founder of Angiecology in 1822 is the author copied the most—credited and discredited. Almost a century subsequent to completion the best anatomist of all languages copy Tiedeman's illustrations.

In our personal dissections 30 % of the trunks of the distal mesenteric artery possessed trifurcation, i. e., three primary independent arteries originated from it, viz.: arteria colica sinistra, arteria sigmoidea, arteria hemorrhoidalis proximal (see Figs. 36, 39, 40, 41, 43, 44).

Type C. represents a mixed description, including such anatomists as Theile (1844), Poirier (1896) and Jonesco (1889).

This type (C) of description practically belongs to the type of (a) where the trunk of the distal mesenteric artery is bifurcated into two primary branches but Thiele (1844), Poirier (1890) and Jonesco (1884) divide the two primary branches into two large subordinate adjacent branches to which they apply names e. g. Theile designates the branches of the arteria colica sinistra as ramus anastomaticus superior (proximal) or colica sinistra superior (proximal colica sinistra, colica media and colica sinistra inferior (distal) and the distal branch (unnamed) is divided into hemorrhoidalis superior (proximal). Another class of anatomists describe the trunk of the distal mesenteric artery as dividing into four or five primary independent branches, e. g., colica sinistra superior (proximal) media and inferior (distal) also one or two hemorrhoidalis proximal to which class belong Testut (1896), Winslow (1752), Debirre (1890), Sappey. (1876). It appears to me that these anatomists are describing anomalies or rather variations of form, accessory arteries. They are dignifying subordinate branches into primary ones. This is an error. It is true the proximal hemorrhoidal artery finally bifurcates, however, the proximal hemorroidal artery primarily consists of a single primary branch—a single trunk and cannot consistently be included as consisting of several primary branches. It is not a paired or bilateral artery.

The Discrepancies of Authors in Regard to the Description of the Distal Mesenteric Artery.

(*Arteria Mesenterica Distal.*)

Personal dissections demonstrate that the common trunk of the distal mesenteric artery presents the following, viz.: (a) It bifurcates, i. e., emits two primary branches (70 per cent.); (b) it trifurcates, i. e., it emits three primary branches (30 per cent.); (c) its proximal branch may bifurcate or emit two branches, i. e., the colica sinistra and sigmoids; (d) the distal branch may emit

two branches, i. e., the proximal hemorrhoidal and sigmoidea. In other word the sigmoid artery may arise from the proximal or distal primary branch of th trunk. When the common trunk trifurcates the median primary branch is th sigmoid artery.

However, some authors will illustrate the trunk of the distal mesenteric a tery as distinctly bifurcated, but immediately describe it as emitting thr primary branches (Harrison Allen, 1873, and Bourgery and Jacobs, 1839). Th illustrations in those anatomies are more accurate than the descriptions. Man anatomists copy Tiedeman (1822) without credit, and therefore is difficult t decide to what type their descriptions belong, because an illustration at once d cides the type distinctly, whether the trunk bifurcates or trifurcates. Erasmu Wilson (1844) presents a distinct bifurcation of the trunk of the distal mese teric artery, but directly describes as dividing into three primary branches- trifurcating. This accurate anatomist's description was not as accurate as h illustration.

George McClellan (1892) presents illustrations of bifurcation and trifurc tion of the common trunk of the distal mesenteric artery, but at once assum a trifurcation, a description into three primary branches—arteria sinistra, si moidea and hemorrhoidalis. Spalteholtz (1898) presents five illustrations wi distinct bifurcation of the trunk of the distal mesenteric artery, however, a sumes a trifurcation as description or triplicate branches, sinistra, sigmoida ar proximal hemorrhoidalis. This discrepancy may be traced through numero anatomies.

With these prefatory remarks we will proceed to describe and illustrate th distal mesenteric artery.

For convenience of description we will divide it into segments, viz.: trunk; II., branches; III., arches; IV., "straight terminal vessel."

I. COMMON TRUNK (TRUNCUS COMMUNIS).

Origin.—It arises, similar to the other main intestinal arteries, from the ve tral surface in the distal third of the abdominal artery.

Its origin is located opposite the third lumbar vertebra in the region of th bifurcation of the jejunal artery. Its location is on the left ventral and later surface of the aorta 1½ inches proximal to the aortic bifurcation and 3 inch distal to the origin of the arteria mesenterica proximal. It emerges from th aorta 2 inches distal to the arteria renalis and 1½ inches distal to the arter spermatica (ovarica). The common trunk is located practically medially ar is unpaired.

Dimension.—It is the least in calibre of the three arteriae colicae—coli dextra, colica transversa, ileocolic. It is markedly less in dimension than th renal and greater than the sermatica.

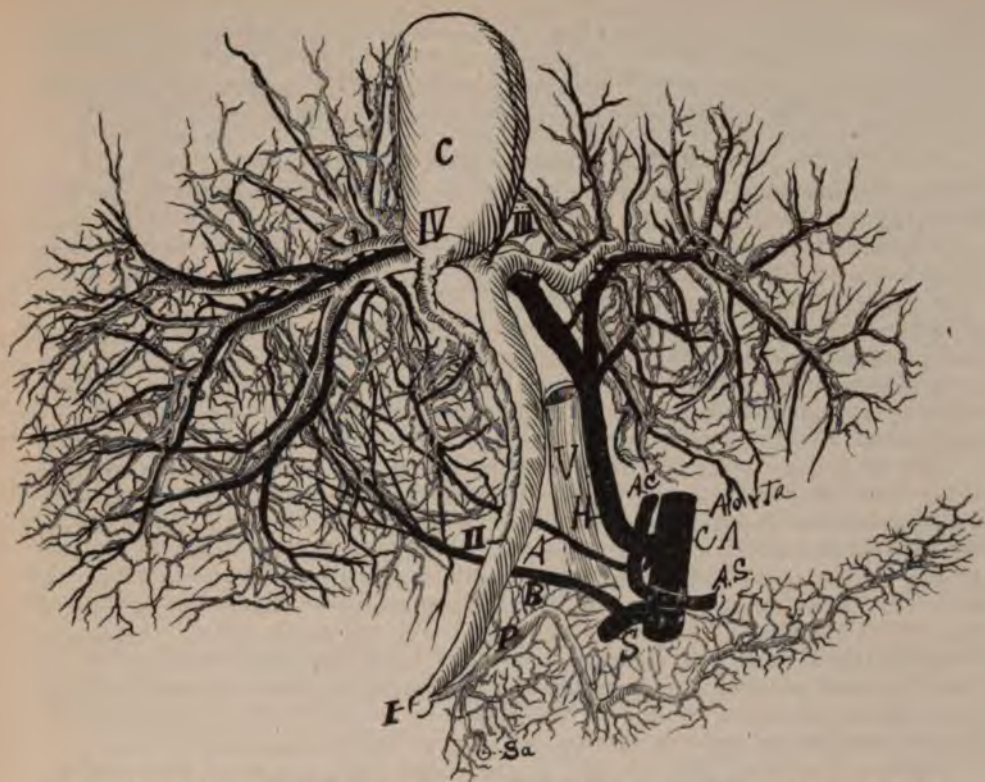
It averages one inch in length and one-eighth inch in diameter.

Course.—It courses dorsal to the peritoneum, ventralward in contact wi the left surface of the aorta and obliquely leftward over the surface of the psoa Whence it primarily bifurcates in 70 per cent. of subjects (into colica sinist and proximal hemorrhoidal) and trifurcates in 30 per cent. of subjects (in colica sinistra, sigmoidea and proximal hemorrhoidal).

The constancy of the distal mesenteric artery is remarkable. The comm trunk is imbedded in a strong sheath of connective and elastic tissue of amp diameter allowing marked peristalsis—expansion and contraction, congesti and decongestion. The common trunk emits only fine branches to adjacent t sue (peritoneum and subperitoneal issue) until it bifurcates or trifurcates.

II. BRANCHES OF DISTAL MESENTERIC ARTERY.

Though the trunk of the distal mesenteric artery bifurcates in 70 per ce of subjects and trifurcates in 30 per cent. of subjects, however, for convenier



X-RAY OF DUCTS BILIS, DUCTUS PANCREATICUS AND ARTERIA HEPATICA.

Fig. 68. This illustration represents the hepatic ducts and hepatic artery traversing the liver, with their relations.

Note that the jejunal artery (proximal mesenteric) emits an hepatic branch (B) to the right liver lobe. Also that the aorta at the foot of the coeliac axis emits a branch to the lobus dexter hepaticus.

Observe the vena cava (V. H.) and relations to the ductus choledochus communis and arteria hepatica.

S, jejunal artery. I, Vater's papilla. P, ductus pancreaticus.

Note spirality of the biliary ducts and hepatic arteries.

of description I shall assume that the artery trifurcates—divides into three primary divisions, viz.: (1) arteria colica sinistra; (2) arteria sigmoidea; (3) arteria hemorrhoidalis proximal.

Some 60 per cent. of anatomic text-books present bifurcation of the trunk of the distal mesenteric artery. Our dissections presented 70 per cent. of subjects with bifurcation of the trunk.

Some 25 of anatomic text-books present trifurcation of the trunk of the distal mesenteric artery. Our dissections presented 30 per cent. of subjects with trifurcation of the trunk.

Ten per cent. of anatomic text-books cannot be classed as maintaining bifurcation or trifurcation of the trunk of the distal mesenteric artery and also their illustrations and descriptions frequently do not correspond.

The plan of the branches of the distal mesenteric artery may be represented by the three following tables, A, B, C.

(A) Common Trunk; (a) Proximal branch—colica sinistra; (b) distal branch—sigmoidea and proximal hemorrhoidal. Bifurcation 70 per cent.

(B) Common Trunk: (a) proximal branch—colica sinistra; (b) middle

branch—sigmoidea; (c) distal branch—proximal hemorrhoidal. Trifurcation 30 per cent.

(C) Common Trunk: (a) proximal branch—colica sinistra and sigmoidea; (b) distal branch—proximal hemorrhoidal. Trifurcation 30 per cent.

Fig. 1. Arteria Colica Sinistra.

The arteria colica sinistra or left colica arteria is the proximal branch of the trunk of the distal mesenteric artery.

Course.—It courses irregularly, sometimes zigzag leftward and proximalward dorsal to the peritoneum and over the ventral surface of the left kidney (see figs. 38, 50) toward the left colon.

In its courses it emits fine branches to the adjacent tissue especially to the mesenterium peritonei and mesenterica membrana propria, particularly to mesenteric glands. The colica sinistra is embedded in a moderately strong sheath of connective tissue of ample lumen to permit marked peristalsis—hypermia during colonic functions (sensation, peristalsis, absorption, secretion).

Branches.—In general the left colic artery trifurcates, is divided into three branches, viz.: (a) Proximal branch—ramus (anasomaticus) proximal sinistra—which anastomoses with the ramus (anastomaticus) dextra of the Riolan-Haller arch. (b) Medial branch—arteria transversa forming the arch of the ramus media—which anastomoses the ramus proximal to the ramus distal. (c) Distal branch, ramus distal, which anastomoses the ramus media with the arteria simoidea.

Dimension.—The arteria colica sinistra is 1/12 of an inch in diameter and extends from its bifurcated trunk to the middle of the transverse colon to complete the "entero-colic circle" or the Riolan-Holler arch, which may include a length of twelve inches.

Arches of the Arteria Colica Sinistra.

In 17 subjects the average number of arches in the arteria colica sinistra was 9, the minimum was 3, the maximum was 20.

The arches of the left colic artery are located between the left half of the transverse colon and point where the left mesocolon turns rightward to cross the psoas muscle.

The arches of the left colic artery occupy the renal region. In some subjects an arch will almost completely surround the kidney (see Figs. 38, 51, 50).

The arches of the left colic artery are located between the left half of the arch producing what might be termed arterial fields. W. Waldeyer, the prince of applied anatomy in German, has written excellent suggestions on what he terms the "Arterial Fields of the Abdominal Cavity." The arches of the left colic artery occupy the left "renal field." The left arch resembles those of the proximal colonic segments, especially those of the right colon in dimension, form, diameter, of anastomatic vessels and relation to colon. They are characterized by multiplicity, by maximum and minimum dimension, by irregularity of form, by non-compact anastomosis, by prominent diameter of anastomotic vessel, by marked proximity to the left colonic border, by one to three series of arches. In some subjects (32, 38, 35) the arches of the left colic artery not only lies in contact with the colonic borders but may lie on the ventral surface of the left colon.

"Vas Coli Terminale Rectum."

The "straight terminal vessel" of the left colon is perhaps slightly less in length than that of the proximal colonic segments. It is, however, of ample length (½ to 1 inch) for ligation or better clamping, during resection, lateral anastomsis or circular colorrhaphy, without molesting the left mesocolic arches which are of significant importance on account of their engagement in the for-

mation of the Riolan-Haller arch—one of the longest vascular arches in the body (see Figs. 35, 36, 48, 44, 43, 39). The Riolan-Haller arch may measure 18 inches. The straight terminal vessels of the left colic artery is located between the mesocolic arches and the right border of the left colon.

The arteria colica sinistra possesses two kinds of "straight vessel," viz.: (a) the long straight vessel, which extends beyond the colon to supply the appendix epipoicus; (b) the "short straight vessel," which supplies dorsal and ventral walls of the left colon only.

2. Arteria Sigmoidea.

In 19 subjects the average was four sigmoid arteries. The maximum number was nine. The minimum number was two. Some latitude of personal judgement and equation must be considered.

Origin.—The sigmoid artery may have three distinct origins, viz.: (a) from this distal branch of the trunk of the arteria mesenteric distal, i. e., from the proximal hemorrhoidal artery, (b) directly from the trunk of the arteria mesenterica distal, i. e., where the trunk trifurcates; (c) from the proximal branch of the trunk of the distal mesenteric i. e., from the arteria colica sinistra. When the sigmoid artery arises from the distal or proximal branch of the trunk it occurs at a short distance from the bifurcation. It is the middle branch—ramus media—of the arteria mesenterica distal. There may be several sigmoid arteries usually 4—a range from 1 to 9, see Fig. (23).

A sigmoid artery may arise from the proximal and distal primary branch of the trunk of the distal mesenteric artery in the same individual (see Figs. 32, 28, 26).

Course.—The sigmoid artery courses irregularly distalward and leftward between the mesosigmoid blades, to supply the sigmoid flexure. It passes ventral to the psoas muscle and ureter. It forms between the mesosigmoid blades an uncertain number of compact amastomatic arches. The sigmoid artery anastomoses proximalward with the arteria colica sinistra and distalward with the arteria hemorrhoidalis proximal. In its course the sigmoid artery is ensheathed in powerful cylinders of connective tissue of ample lumen to allow function, especially peristalsis. The mesenterii membrana propria in which the sigmoid artery is imbedded is among the thickest and strongest of mesenteries, and generally further hypertrophied by mesosigmoiditis due to psoas trauma.

"Vas Sigmoidea Terminale Rectum."—The "straight terminal vessel of the

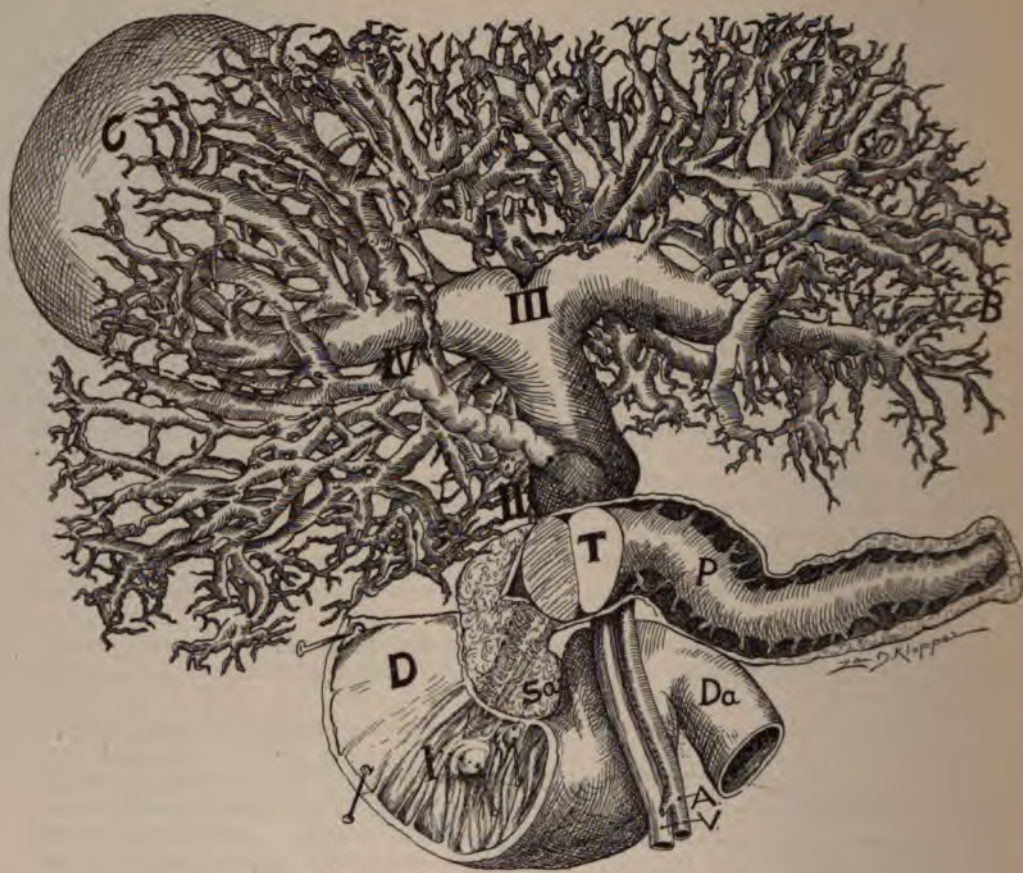
Dimensions.—The sigmoid artery is one-tenth of an inch in diameter, and from two to four inches in length.

Arches of the Sigmoid Artery.—In 18 subjects the average number of sigmoid arches was 10, maximum 16, minimum 5. The arches of the sigmoid artery are characterized by multiplicity, limitation of dimension, prominent diameter of anastomatic vessels, solid and compact anastomoses, irregularity of form, proximity to sigmoid border, maximum connective tissue sheathes a serial order of two with occasionally three arches.

The arches of the sigmoid artery resembles in form and dimension the ileocolic arches of the second series of the mesenteron arches. In general there are one to three sigmoid arches of primary order and maximum dimension, the remaining sigmoid arches are of secondary order and minimum dimension.

sigmoid" may be among the smallest "straight terminal vessel" of the intestine. Its length (½ to 1½ inches) is, however, ample for ligature or clamp during sigmoid surgical procedures, without molesting the "sigmoid arches" and thus avoiding the jeopardy of gangrene or sigmoid ulceration from disturbing its blood supply.

The "vas sigmoidea terminale rectum" is ensconced in thick powerful sheaths of connective tissue which is frequently enhanced by sigmoiditis due to



DUCTUS HEPATICUS DILATED.

Fig. 69. This illustration represents an X-ray of the hepatic ducts dilated seven times their normal dimensions, due to a malignant tumor (T) located in the pancreas. The tumor is bisected. The pancreatic duct (P) was dilated to the dimensions of a man's thumb—perhaps 40 times its normal dimensions. The dilated hepatic ducts would compromise the arteria hepatica and vena cava (hepatic circulation). The man from whom I obtained this specimen lost 100 pounds in weight during the last three months of his life.

The carcinoma at (T) obstructing the ductus choledochus communis and ductus pancreaticus.

I secured this specimen at on autopsy through the courtesy of Dr. Charles O'Byrne.

The hepatic ducts were dilated 7 times the normal caliber.

psoas trauma. Perhaps four to six straight terminal sigmoid vessels may occur to the inch, abundantly supplying the sigmoid.

The straight terminal vessel of the sigmoid in dimension (length and diameter) and number lies midway between those of the enteron and colon. They pass to the dorsal and ventral wall of the sigmoid. There are two kinds of "straight terminal vessels" supplying the sigmoid, viz., a "long straight vessel," which passes from the sigmoid arch to the appendix epiploicus and a "short straight vessel" which passes to the ventral and dorsal surface of the sigmoid and does not supply the appendix epiploicus. The "long straight vessel" in the sigmoid averages about an inch in distance from each other.

In order to expose the "straight vessel" of the sigmoid it must first be freed, liberated from it mesosigmoid adhesions, due to the psoas trauma, which occur

in about 80% of adults when the "straight vessel" may be attacked from the right or left side of the mesosigmoid.

A powerful crushing clamp will arrest the hemorrhage in the "straight vessel" in two minutes.

3. Arteria Hemorrhoidalis Proximal.

The proximal hemorrhoidalis artery is the distal branch of the distal mesenteric artery of which it appears as a direct continuation.

Course.—It courses distalward dorsal to the peritoneum intimately adjacent to distal abdominal aorta, ventral to the left common iliac artery and ureter on the left side of the promontorium, on the left ventral surface of the sacrum between the blades of the mesosigmoid and mesorectum and on the dorsal surface of the rectum whence it bifurcates and anastomoses with the arteria hemorrhoidalis media (from the ventral division of internal iliac) and arteria hemorrhoidalis distal (from the internal pudic). Some six inches proximal to the anus the proximal hemorrhoidal artery bifurcates and each branch courses along the lateral border and of the sigmoid and rectum. About five inches proximal to the anus each of these lateral branches subdivide and bifurcate into three or four branches which pierce the rectal muscular coat three inches from anus.

These branches located at regular intervals in the lateral wall pass distalward between the rectal muscularis and nucosa to the anus. At the distal end of the rectum the proximal hemorrhoidal artery unites in loops and anastomoses with the arteria hemorrhoidal medial and distal. The proximal hemorrhoidal artery emits no rightward branch from its right side (except fine threads for the nourishment of the peritoneum, membrana mesenterica propria and mesenteric glands).

In the majority of subjects the arteria sigmoidea is a branch of the arteria hemorrhoidalis proximal.

Dimensions.—The diameter of the proximal hemorrhoidal artery is one-eighth of an inch and its length is twelve inches.

Arches of the Proximal Hemorrhoidal Artery.—In 20 subjects the average number of the hemorrhoidal arches was 5, the maximum was 9. The minimum was 2. The arches of the hemorrhoidal arteries are formed by the anastomosis of its branches with those of the sigmoid artery.

When the proximal hemorrhoidal artery ceases to produce arches it bifurcates about five inches proximal to the anus, and attends the distal end of the sigmoid and rectum. The arches of the distal hemorrhoidal artery are characterized by limited number of maximum and minimum dimension, solid and compact anastomosis, significant diameter to the anastomotic artery and proximity to the sigmoid border.

There is frequently one arch of maximum dimension (see Figs. 26, 35, 28, 32, 43, 39, 42, 41, 44, 47) accompanied by several of minor dimension. In general there is in the arches of the proximal hemorrhoidal artery one of maximum dimension and several of minor dimension.

Vas Proximal Hemorrhoidalis Terminale Rectum or "straight terminal vessel" of the proximal hemorrhoidal artery are distinct, of ample length (½ to 1 inch) for ligature or clamp without molesting the arches of the proximal hemorrhoidal artery. The "straight vessel" emitted from the arches of the proximal hemorrhoidal artery are less in number and greater in dimension than those of the sigmoid artery. The proximal hemorrhoidal artery arches average half the number of those of the sigmoid and left colic arteries. Between the last arch of the proximal hemorrhoidal artery and its primary bifurcation there is a space distal end possess only one kind of "straight vessel" as there are no appendicae free from the large "straight vessel." The proximal hemorrhoidal artery at its epiploicae requiring a long and short "straight vessel."

III. ARCHES OF DISTAL MESENTERIC ARTERY.

In 20 subjects the average number of arches in the distal mesenteric artery was 25, the maximum was 41, the minimum was 12. The arches of the distal mesenteric artery composed by the anastomoses of its branches are characterized in general by both maximum and minimum dimensions, by both compact and noncompact anastomosis, multiplicity, and, limited number, marked diameter of anastomotic vessels, pronounced irregularly of form, proximity and nonproximity to the colonic border, by circumscribing definite areas and marking the limits of viscera and serial arder from 1 to 3.

The distal arteria mesenterica forms two kinds of arches, viz.: (a) mesocolonic arches which conduct the blood to the colon, powerful arches with anastomotic arteries of significant diameters. (b) Peritoneal arches, arches which conduct blood to the membrana peritonei, mesenteric glands and membrana mesenterii propria, arches with anastomic vessels of limited diameter.

The arches are located between the trunk and the "straight terminal vessel" of the colon. The mesocolic are located practically adjacent to the colon rather than the aorta.

In the sigmoid artery the arches are characterized by marked multiplicity and compact, solid arch, conducting a vast volume of blood. The sigmoid artery averaged 10 arches, the maximum number was 16, the minimum was 4.

The arches in the left colic artery are characterized by almost the same qualities (number, dimension) as those of the sigmoid. The left colic artery average 9 arches. The maximum number was 20, the mimimum was 3. The arches in the proximal hemorrhoidal average 5. The maximum was 12. The minimum was 2.

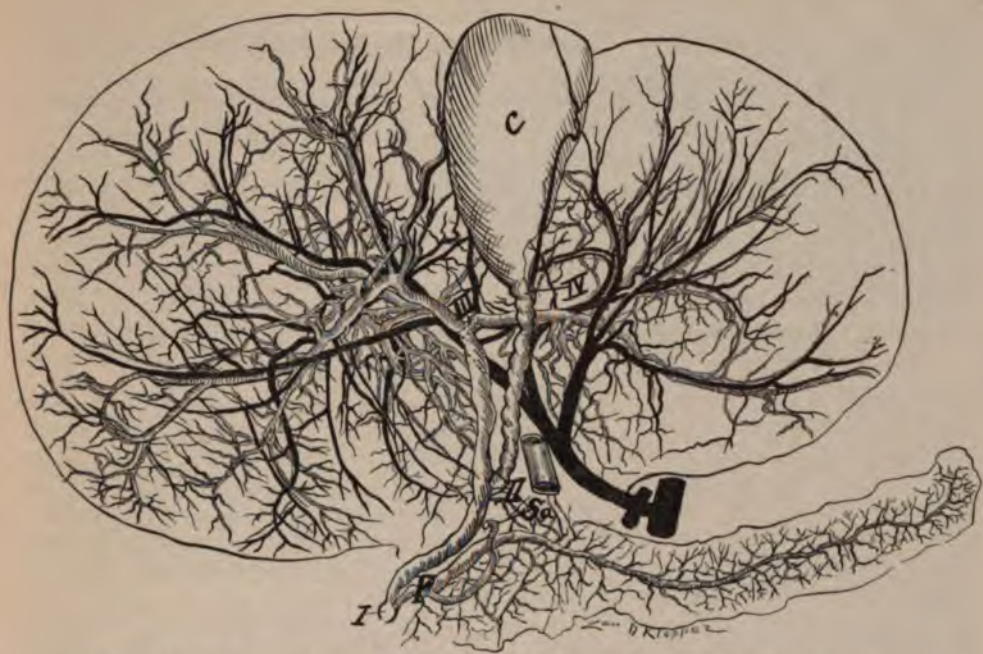
Utility of Arches.—The arches of the arteria mesenterica distal are composed of significantly large arteries conducting a large volume of blood. The function, physiology, of the distal mesenteric arteries is to direct the blood volume in maximum currents to required localized points of the colon when local function (sensation, absorption, secretion peristalsis) is required precisely similar to the solid anastomosis of the utero-ovarian artery (the genital vascular circle) which can direct a maximum blood current to a localized point in endometerium or endosalphinx to nourish an ovum or neoplasm.

Arches insure uniform distribution of blood volume. If the blood current be obstructed to a territory the arches enable it to be sufficiently supplied by collateral anastomosis.

The mesenterial arches of the tractus intestinalis, solidly and compactly anastomosed through inosculating arteries of significant diameters, accommodate themselves to the position and state of distentions and contraction of the tractus intestinalis. Blood intitiates, produces function, and when any local intestinal segment required its function exacerbated enormous blood volumes can be concentrated on the desired segment by means of the voluminous mesenteric arches, while other intestinal segments will be suplied with sufficient blood for their tissue nourishment. The mesenteric arches with their significantly diametered, inosculating arteries are doubtless a phylogentic development of the tractus intestinalis these remarkable mesenteric arches with such solid and compact anastomosis through such maximum diametered arteries are an evolutionary development to accommodate function of the tractus intestinalis.

Arterial Fields of the Distal Mesenteric Artery (Areae Arteriacae).

The branches of the distal mesenteric artery form characteristic arches on the dorsal wall which circumscribe definitive or independent fields. The arterial arches project the peritoneum ventralward, and in this fold may be felt the pulsating artery. These arterial fields are so arranged that positional relations of viscera may be established and a knowledge of the arterial field may be ultilized



ARTERIA HEPATICA, DUCTUS HEPATICUS, DUCTUS PANCREATICUS.

Fig. 70. This illustration represents an X-ray of the hepatic artery, hepatic ducts, vena cava, and ductus pancreaticus.

Observe the dimensions, relations, bifurcations, and angulations of the great structures (ducts and arteries) that traverse the liver.

The injections of the hepatic structures were executed under similar pressure. The X-rays in all the illustrations were highly magnified and employed as a model by the artist, Dr. Zan D. Klopper.

1, Vater's papilla. P, Pancreatic duct. S, ductus pancreaticus accesorius (Santorini's duct).

Note spirality of ducts, arteries assume spirality.

for localization of viscera during peritonotomy. Arterial fields are only of practical worth on the dorsal abdominal wall. The arterial fields (arches) are of less practical value in the areas of mesenteries of maximum length and mobility. However, the "ileocolic circle" and the Riolan-Haller arch will always demand the most careful respect in intestinal surgical procedures. They are arterial fields of practical importance. If the colon transversum be reflected proximalward the great field of the Riolan-Haller arch is visible—the right, the lesser and the left the greater (see Figs. 38, 41, 42, 23, 27, 28). The arterial field of the Riolan-Haller arch is reduced, divided when an arteria transversa accessoria is present. The artery of Waldeyer is present sufficiently frequent to consider it constant in surgical procedures.

The left side of the Riolan-Haller arch is the arterial field which concerns the distal mesenteric artery, it is the renal field, area renalis sinistra. In my opinion the renal field is the only one of practical value among the arches of the distal mesenteric artery. Prof. Wm. Waldeyer, the master of practical anatomy in Germany, adds the ureteral field, area urterica sinistra; however, I am unable to view it as of practical value during peritonotomy. The arterial fields are the most pronounced in space in infants. In the left renal field may also be found not only the left kidney but the adrenal, a large segment of the ureter, a portion of the gastrium, pancreas and spleen. The sigmoid arches present no recognizable, established arterial field.

Frequently the left renal arterial field includes the distal portion of the kidney only, especially in adults.

In maximum arterial fields with minimum panniculusadiposus the center of the field may be so depressed that it appears like an inverted dome. The peritoneal border of the arterial field appears markedly projected like a ring, with the artery coursing in its circumferential fold which in pronounced spare subjects produces the appearance that the artery possesses a kind of mesoanguim. The arterial fields, arae arteriacae, may not be observed only but palpated also. I have associated two aterial fields with the distal mesenteronic, viz.: The left Proximal "major mesocolic circle" and the left distal "major mesocolic circle."

4. Straight Terminal Vessel of the Distal Mesenteric Artery.

(*Vas Coli Terminale Rectum.*)

Surgery is the father of anatomy. Practical and experimental surgery demonstrate that the "straight vessel" of the disal mesenteric artery is the most significant of all its segments (trunk, branch or arch). The "straight vessel" is the safe location for the application of the ligature, but especially the powerful crushing clamp. Its ample length avoids ligation or clamping of the mesocolic arches which might initiate colonic gangrene or ulceration of colonic mucosa. The "straight vessel" of the distal mesenteric artery is located between the peripheral mesocolonic arch and the mesocolic border.

The dimension (length and diameter) of the "straight vessel" of the distal mesenteric artery is of ample length (½ to 1½ inches) through its entire distribution to be ligated or preferably clamped with powerful pressure forceps without molesting colonic wall or mesocolic arches.

There are two kinds of "straight vessels" at the periphery of the distal mesenteric artery depending originally on the presence or absence of the appendix epiploicus.

There is: (a) The "long straight vessel" which extends from the mesocolic arch to the colon and eventually in the interior of the appendix epiploicus to supply its tissue. The "long straight vessel" will perhaps average one to the inch and is one-third greater in dimension (length and diameter) than that of the "short straight vessel."

There is: (b) the "short straight vessel" which extends from the peripheral mesocolic arch to supply the dorsal and ventral colonic wall. The "short straight vessel" will perhaps average four to the inch, and is one-third less in dimension (diameter and length) than that of the "long straight vessel."

The "straight vessel" of the distal mesenteric artery differs in characteristics, number, dimension in the three different distal colonic segments—left colon, sigmoid, rectum.

A general characteristic of the "straight vessel" of the distal colon is that it emerges from the arch as a single trunk and bifurcates with equal volumes or unequal volume. If the bifurcation be of uniform branches they extend either all to one surface of the colon or some extend to the dorsal, and some the ventral surface of the colon.

If the bifurcation of the "straight vessel" result in unequal diameter in its branches all the branches may extend to one surface of the colon or divide, some supplying the dorsal and some to the ventral colonic surface. If one branch of the bifurcation be of markedly less dimension than the other the smaller branch not infrequently spirally rotates about the larger. The distal mesenteric artery possesses a spiral state. The "straight vessel" may arise from the median surface of the "mesenteric arch" and pass lateralward to the colon by coursing dorsal or ventral to the arch. In general the "straight vessel" originates from the circumference of the mesenteric arch most adjacent to the colon, however, occasionally it originates from a mesenteric arch located more medianward

adjacent to the trunk. The characteristics of the "straight vessel" of the left colon are: It is of sufficient length for ligation or clamping without danger to the mesocolic arch or colonic wall. Not infrequently the arch of the arteria colica sinistra lies in contact with the left mesocolic border or on the ventral surface of the left colon (see Figs. 38, 37, 35, 32) lending the appearance that the "straight vessel" was absent. . However, the "straight vessel" is not absent and by tension in opposite direction on the arch and left colon the "straight vessel" becomes evident. Slight blunt dissection will expose ample lengths for ligation or clamping. Should the arch of the arteria colica sinistra be ligated it might be a segment of the Riloan-Haller arch and be accompanied by the disaster of colonic gangrene or colonic ulceration. The "straight vessel" located in the bifurcation of the branches of the arteria colica sinistra frequently present marked length and diameter.

The "straight vessel" of the arteria sigmoidea is greater in number, but less in dimension than those of the left colicartery. In short, the "straight vessel" except perhaps those supplying a short segment of the distal ileum, the sigmoid possesses the "long straight vessel" and the "short straight vessel" similar to other colonic segments in which the appendix epiploicus is situated. The "straight vessel" of the sigmoid is of ample length (½ to 1½ inches for safe ligature or clamp. More vigorous blunt dissection is required to expose the "straight vessel" in the sigmoid than in another segment of the colon an account of maximum tissue in the mesosigmoid. However, on account of the solid and compact anastomosis of the sigmoid arches an accidental ligature or clamping of a messosigmoid arch would probably not jeopardize the vital integrity of the sigmoid.

The "straight vessel" of the proximal hemorrhoidal artery resembles the "straight vessel" of the arteria colica sinistra, in number and dimension. When the arches of the proximal hemorrhoidal artery ceases the "straight vessels" emerge from branches, produced by its repeated bifurcation, in regular order and at equal intervals, being frequently of marked dimension. At the distal portion of the rectum the "straight-vessel" unite in loops on the dorsal and ventral surface of the rectum.

THE "ENTERO-COLIC CIRCLE."

The "Entero-colic arch."

Dissection. Inject completely through the arch of the aorta the abdominal viscera. Incise the abdomen wall crucially, reflect the transverse colon proximalward, remove the distal mesocolic blade and the transverse colic artery with its "Entero-colic circle" will be exposed.

Synonyms, Entero-Colic Arch. Arcus transversus mesocolicus.

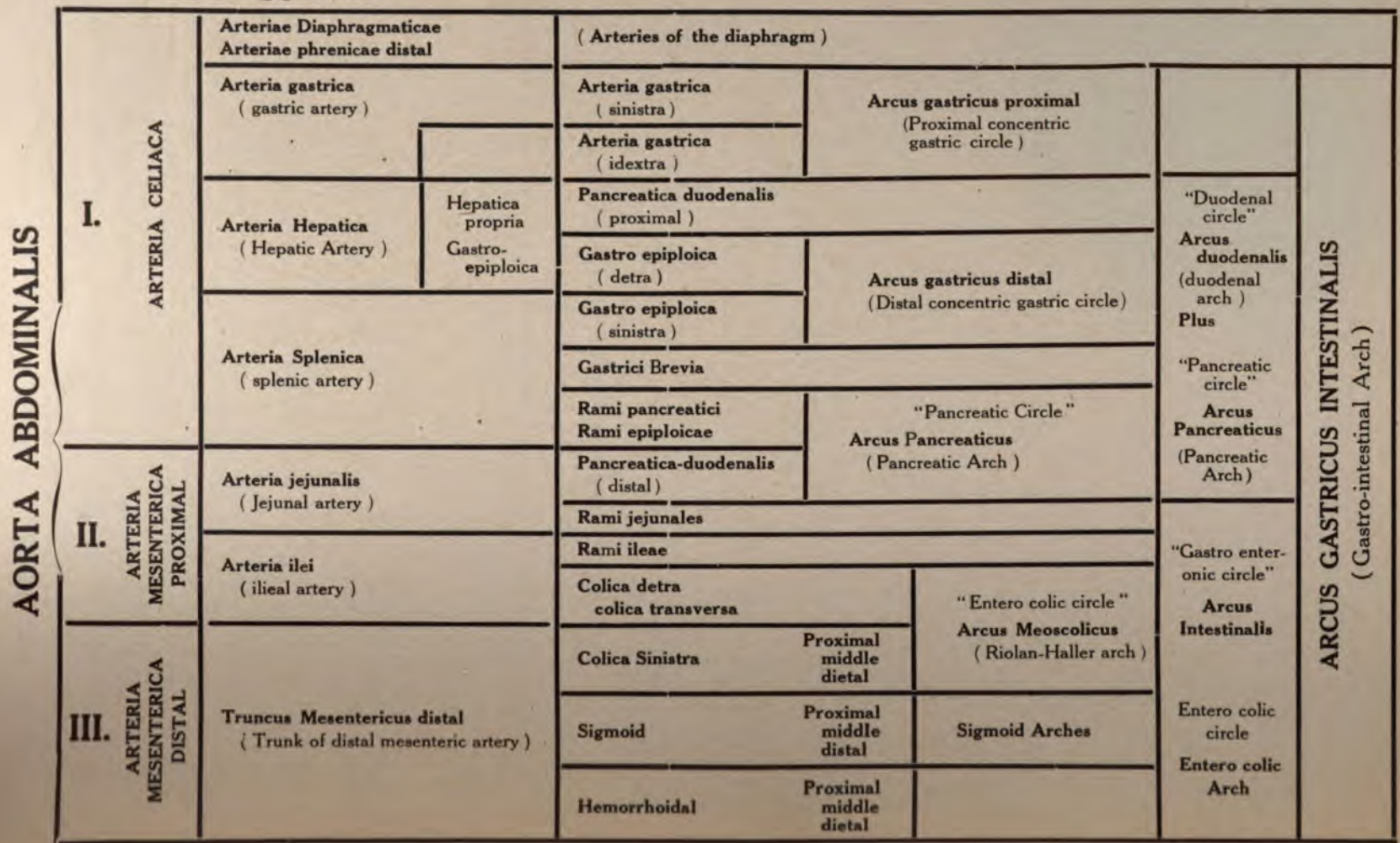
Arcus Colicus transversus. Anastomotica Magna.

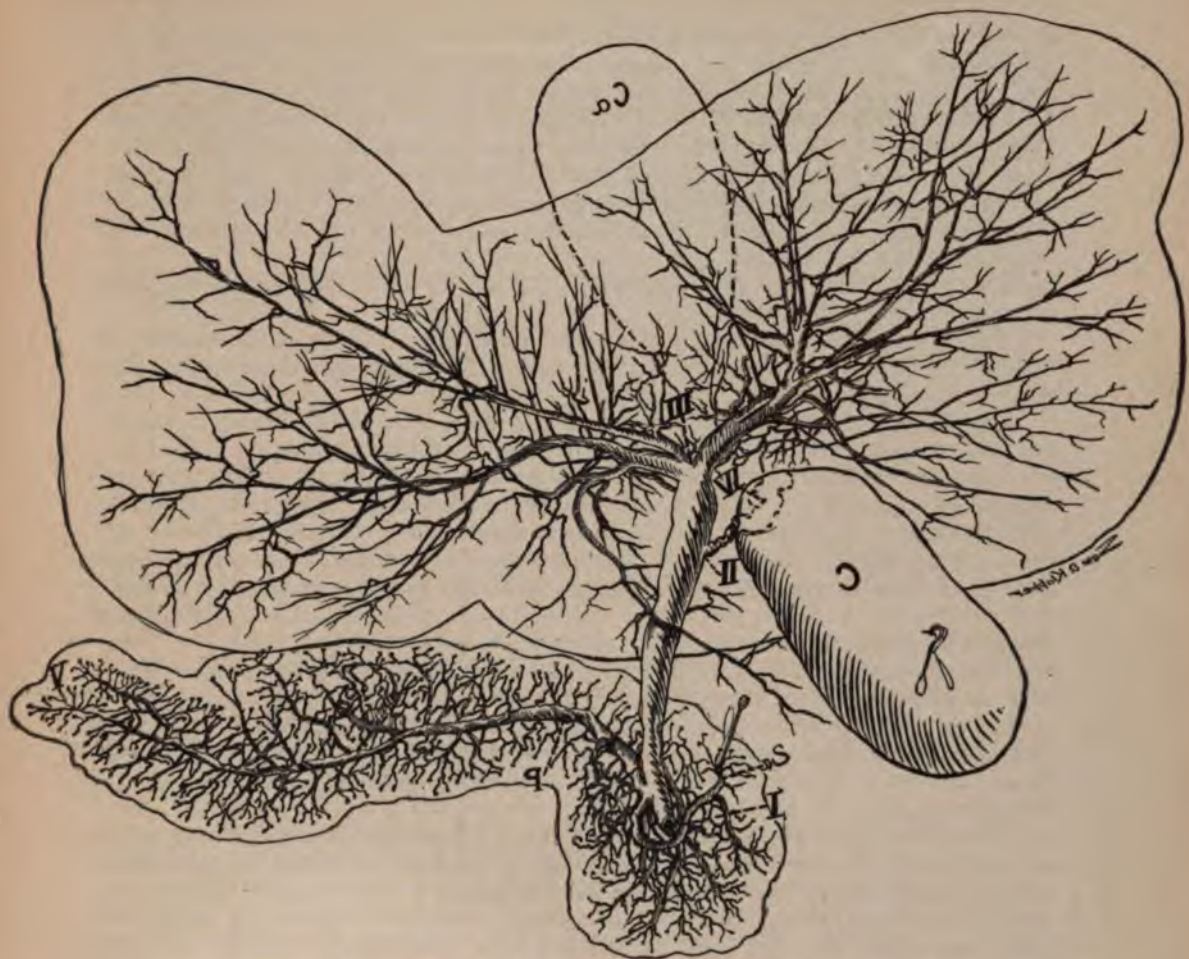
The greatest vascular arch. Arc of Jean Riolan, French Anatomist (1580-1657), professor in Paris, Arcus Riolani, L' Arcade de Riolan, Arc of Albertus Von, Haller, Swiss Anatomist and Physiologist (1708-1777), professor in Berne, Arcus Hallerii. The Arc of Haller. The *Riolan-Haller Arch* (Byron Robinson).

Origin. The "Entero-colic circle" or arc has a left origin from the proximal end of the jejunal artery (Ex arteria jejunalis) and a right origin from the colica sinistra, which is a branch of the arteria mesenteric distal. Practically the "Entero-colic circle" possesses a right origin from the jejunal artery and a left origin from the distal mesenteric artery (the remaining segment of the "Entero-colic circle" is completed by the trunk of the distal mesenteric artery, the segment of the aorta located between the origin of the jejunal artery and the distal mesenteric artery, also the proximal segment of the jejunal artery).

Course. The segment of the "Entero-colic circle" of interest to medicine

The solid and compact anastomosis of the unpaired arteries of the abdominal viscera (tractus intestinalis) *presents the following picture:*





DUCTUS BILIS AND DUCTUS PANCREATICUS.

Fig. 71. This illustration represents an X-ray of the hepatic and pancreatic ducts. Note the spirality of the ducts, their angulation, their caliber, their bifurcation.

I. Vater's Papilla presents a common orifice for the ductus choledochus and ductus pancreaticus.

Sa presents the orifice of the ductus pancreaticus accessorius (Santorini's duct.)

C, cholecyst.

The arteries, veins and ducts of the liver practically follow identical routes.

and surgery courses from its right origin in the jejunal artery obliquely ventralward and rightward between the transverse mesocolic blades, along the border of the transverse mesocolon to the splenic flexus, whence, it continues its course along the border of the left meso colon to the left origin from the trunk of the distal mesenteric artery.

The course of the "Entero-colic Circle," through the transverse meso-colon as regards the distance from the border of the transverse colon presents considerable variation on account of the factor of the presence or absence of superimposed minor vascular arches, which require space—increasing the distance between the transverse colon and the circumference of the "Entero-colic circle," The superimposed minor vascular arches are interposed, interpolated, between the periphery of the "Entero-colic circle" and the transverse mesocolon, especi-

ally marked in numbers at the colon flexures, aiding not only solid and compact anastomosis but insuring the safety of surgical operations, by enabling the surgeon to avoid the ligation or clamping of the main "Entero-colic Circle."

Superimposed arches on the circumference of the Riolan-Haller Arch increase the distance between the transverse colon and the Riolan-Haller Arch."

Dimensions. The dimensions of the "Entero-colic circle," is extremely variable, mainly depending on accessory arteries, single or multiple and resulting arches. The less the number of accessory arteries, the greater the single arc and vice versa.

Fig. (23) presents a typical example of numerous accessory arteries and diminished size of arches.

The mesocolic arc of the "Entero-colic circle" will frequently measure 15 inches in length, in some subjects 18 inches. The complete "Enterceronic circle" may measure two feet.

The lumen of the mesocolic segment of the "Enterocolic circle" is perhaps 1/10th of an inch in diameter. It is evident that a single vascular arc of 18 inches in length is vastly more jeopardising to health and life than an arc of less length. If a single giant arc like that belonging to the "Entero-colic circle" becomes, ligated, clamped or obstructed by an embolus, the colon becomes jeopardized to ulceration and gangrene. Through accessory arteries multiple arches are created, increasing the solidarity and compactness of the collateral circulation in the arc of the "Entero-colic circles." Through multiple arches the collateral circulation is increased in efficiency and certitude. The pictures of figures (26) and (28) tells the story of a single are and multiple ones, a thousand fold better than descriptions.

Figure (26) presents the "Entero-colic circle" with practically a single mesocolic arc and collateral circulation is at a minimum. Obstruction of the single arc would jeopardize the minimum collateral circulation—inviting ulceration or gangrene of the colon.

Figure (28) presents the mesocolic are of the "Enteronic circle" with multiple accessory arteries and consequently multiple arches, resulting in maximum collateral circulation. Obstruction of any single arc would be, by ample collateral circulation, immediately compensated. Multiple arteries and arches increase the efficiency, safety and certitude of the collateral circulation. Hence the dimension and efficient circulation of the "Enterocolic circle" depends on the number of accessory arteries and consequent created arches. The "Entero-colic circle" is chiefly diminished, interrupted by the accessory transverse colic, or what I eponymize as Waldeyers artery, see figures (27), (28), (38), (40), (41), (42), (47).

Form. There are several forms of the "Entero-colic circle," depending on the anatomic fact whether the transverse colic artery originates independently or as a common trunk with the right colic artery and also whether there exists an accessory transverse colic artery (Waldeyer's Artery).

1. The form of the "Entero-colic circle" when the transverse colic artery arises *independently* from the jejunal artery, see figures. (23), (25), (33), (35), (36), (37), (40), (43), (45), (64), (66).

In general the more proximalward the transverse colic artery originates from the jejunal artery, the less the entero colic arc will be in dimension. Hence, with an independent origin, from the jejunal artery for the transverse colic artery, the dimension of the "Entero colic circle" will be medium or minimum.

The independent origin of the transverse colic artery, located well proximalward, not infrequently divides the mesocolon into a right proximal "major mesocolic circle"—and a left proximal "major mesocolic Circle"—arterial fields of similar dimensions, see figures (34) (37).

2. The form of the "Entero-colic Circle" when the transverse colic artery

arises as a *common trunk* with the right colic arteries see figures (22), (26), (30), (32), (39), (44), (46), (47), (50), (51), (52), (54), (55), (58), (59), (62). In general if the transverse colic artery originates as a common trunk with the right colic artery, the "Enteronic circle" will be of maximum or medium dimension. The more distalward the common trunk of the right and transverse colic arteries is located on the jejunal artery, the greater is the dimension or area of the "ileocolic circle." With a common trunk (for right and transverse colic arteries) located well distalward on the jejunal artery generally the mesocolon is divided in a lesser right proximal "major mesocolic circle"—and a greater left proximal "major mesocolic circle"—arterial fields of unequal dimension, see figures (30), (32), (40), (44), (46), (54). Though the arterial fields of the right and left proximal "Major mesocolic circles," formed by the Riolan-Haller arch are of less anatomic prominence surgical utility than the right and left distal "Major mesocolic circles" yet in surgical procedures on the transverse colon, they may be of extreme practical utility.

3. The form of the "Enteron circle" when it is interrupted by accessory arteries, as an arteria colica transversa accessoria (Waldeyers Artery), see figures (27), (28), (34), (38), (41), (42), (47), (58), (59), (62). Accessory transverse arteries multiply arches, changing the form of the "Entero-colic circle" from that of a single circle to that of multiple collateral and concentric circles, increasing the efficiency and fortifying collateral circulation, see figures (38), (47), (58).

The arteria transversa accessoria occurs with sufficient frequency to entitle it to a name, and in honor to professor W. Waldeyer of Berlin, Germany, in recognition of his excellent contributions. I have eponymized it as "Waldeyer's artery." Accessory arteries multiply arches, especially in the hepatic and splenic flexures of the colon, aiding efficient blood supply and increasing the safety of surgical procedures.

4. The form of the "Entero-colic circle" surmounted by minor vascular arches, see figures (22), (30), (32), (35), (38), (440), (41), (42), (43), (44), (45), (47), (50), (54), (55), (64). The greater the number and dimensions of the superimposed minor arches on the "Entero-colic circle" the more efficient and certain is its collateral circulation, also the superimposed arches increase the safety of surgical procedures on account of increased facility of avoiding the obstruction of the main circumference of the "Enterocolic circle" by ligature or clamp.

5. The form of the "Enterocolic circle" with no surmounted or imposed minor or vascular arches, see figures, (23), (25), (26), (27), (28), (32), (34), (36), (37), (39), (46), (58), (59), (62). The single vessel forming the "Entero-colic circle" with no superimposed minor arches is accompanied with the particular danger of becoming ligated or clamped during transverse colon resection, or obstructed by an embolus, figures, (25) and (32) are typical examples. However, the "Straight terminal vessels" of the "Entero-colic circle" is of ample length (1/2 to 2 inches) for ligature or clamp without compromising the great arch. Blunt dissection reveals with facility the constant presence and ample length of the "straight terminal vessel" for surgical application.

The above forms of arches in the "Entero-colic circle" are of interest clinically and surgically.

Conclusions Regarding the "Enteronic Circle."

Definition. The entero-colic arch, the mesocolic arch, The Riolan-Haller arch. Arch of the transverse mesocolon.

The segment of the "Enteronic Circle—The Riolan-Haller arch—of interest in medicine and surgery has two origins, viz: a right origin from the jejunal artery and a left origin from the distal mesenteric artery. The "Enteronic

X-RAY OF ARTERIA HEPATICA, DUCTUS HEPATICUS AND DUCTUS PANCREATICUS.

Fig. 72. This illustration represents the relations of hepatic ducts and hepatic artery, with relation of vena cava (V.).

Note that the hepatic artery bifurcates at its origin from the coeliac axis, one branch (the lesser) coursing dorsally to the vena cava and ductus choledochus communis and the other branch (the greater) coursing ventrally.

Observe the dimension, relation, bifurcations and angulations of the three great structures (hepatic artery, hepatic duct, vena cava) that traverse the liver.

G. A., arteria gastrica.

S, arteria splenica.

I, Vater's papilla.

P, ductus pancreaticus.

Observe that the hepatic ducts and hepatic artery follow identical routes.

circle''—the transverse mesocolic arch—inosculates the proximal mesenteric artery with the distal mesenteric artery.

The ''Enteronic circle'' joins the blood current of the enteron with the colon, the arteria colica transversa (Ex arteria jejunalis) inosculates with the arteria colica sinistra (Ex arteria mesenterica distal) solidly and compactly anastomosing, uniting the blood current of the enteron and colon for the purpose of controlling function (sensation, absorption, secretion, peristalsis).

The ''enterocolic circle'' unites directly the enteron with the colon by means of a single continuous artery, (perhaps 18 inches in length) extending in a curve form through the meso-colon from the jejunal artery to the distal mesenteric artery.

The *course* of the ''Entero-colic circle'' is that of a curve through the transverse mesocolon adjacent to the border of the transverse colon.

The *form* and *dimension* of the Riolan-Haller Arch depends on the location of its (a) right origin from the jejunal artery and (b) left origin from the distal mesenteric, (c) also whether the right origin is (d) independent from the jejunal artery (55%) or arises as (e) a common trunk with the right colic (45%). (f) The form and dimension depends on the presence or absence of ac-

cessory arteries with consequent accessory arches. (g) On the presence or absence of superinposed minor arches, (h) the mesocolic arch—Riolan-Haller arch —may measure 15 or 18 inches in length, the entire circumference of the "enteronic circle" may measure 20 inches to two feet.

Accessory arteries frequently interrupt, divide the "enterocolic circle" to the advantage and certitude of colonic circulation. A single artery or arch for the "entero-colic circle" endangers the integrity of colonic circulation from embolus, and during surgical procedures from ligature or clamp. Accessory arteries multiply the efficiency and safety of circulation by abundant collateral circulation. Multiple vascular arches increase peripheral circulation by abundant collateral anastomosis. The frequently occuring accessory transverse artery or "Waldeyer's artery" fortifies the integrity of the "enteronic circle," increasing the collateral circulation of the colon.

Superinposed minor arches are a significant feature and occur frequently in association with the "entero-colic circle." The superinposed arches increase the integrity of circulation by abundant collateral anastomosis, thus avoiding the chief danger of embolus. The superimposed arches increase the safety of surgical procedures on the transverse colon, by allowing ample space for ligature and clamp without compromising the main arc.

It is of extreme practical significance in surgical procedures on the transverse colon that the "entro-colic-circle" or Riolan-Haller arch be not obstructed, by ligature or clamp, as it might jeopardize the colon to ulceration or gangrene.

The *"straight terminal vessel"* of the "entero-colic circle" is of ample length (½ to 2 inches) for the ligature or clamp. without compromising the circumference of the main arch, and consequently jeojardizing the transverse colon to ulceration or gangrene.

Waldeyer's artery makes more solidly and compactly the circulation of the transverse colon, the magnitude of which endangers peripheral in the entero-colic circle. Mulitple vascular arches insure ample peripheral circulation by abundant collateral anastomosis.

The *clinical signification* of the "entero colic circle" or mesocolic arch is its intimate relations to the transverse colon, as regards hyperaemia for digestion, self nourishment, embolus and surgical procedures. During resection of the transverse colon, the "straight terminal vessel" alone must be clamped or ligated, not the "entero-colic circle." Ligation or clamping of the "entero-colic circle" might jeopardize the transverse colon to ulceration, gangrene.

The *functionation* of the "entero-colic circle" is produced by stimulating its automatic specialized peripheral ganglia (Auerbach's and Billroth's-Meissner's), which dilates its arteries, enticing hyperaemia, engorgment for physiologic purposes—not merely tissue nourishment. The "enteronic circle" is the apparatus for executing hyperaemia, engorgement of the transverse colon.

The *utility* of the "entero-colic circle" or the Riolan-Haller arch is to maintain a continuous maximum blood volume to the transverse colon with maximum collateral circulation for physiologic objects, also to transport blood volume from enteron to colon or vice versa as required for localized function (sensation, secretion, absorption, peristalsis) in enteron and colon.

In important viscera there is a tendency to form the *"inosculation circle."*

SECTION III.

ARTERIAL FIELDS OF THE ABDOMEN.

Areae Arteriacae.

Proximal and Distal "Major mesocolic circles."

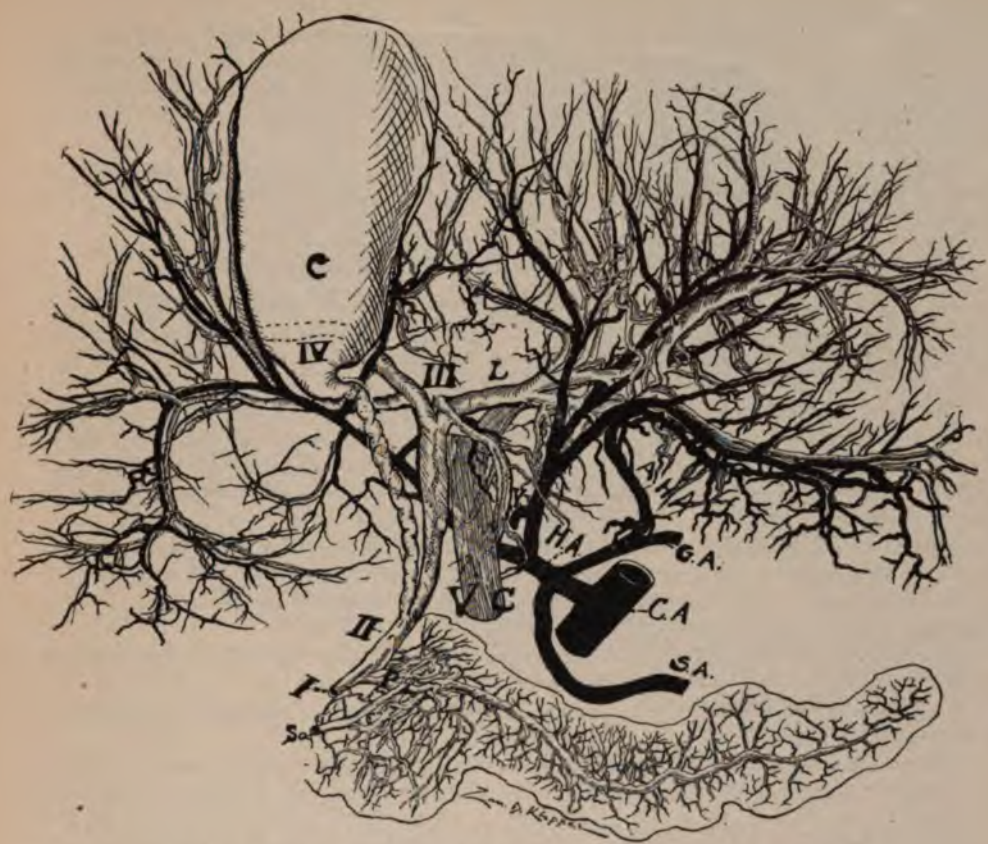
The branches of the proximal and distal mesenteric arteries form characteristic circumscribing circles, arches, definitive, independent arterial fields or arterial areas.

The colic arteries present prominent arterial fields on the dorsal abdominal wall which circumscribe viscera and form marked visceral boundaries.

The "mesocolic circles" or arches are so arranged that established visceral relations exist between them and the abdominal viscera and knowledge of the relations of "mesocolic circles" and viscera is of practical value in abdominal surgery. Conditions may arise within the abdomen, from abcesses distorting visceral relations or excessive accumulations of fat, where palpation of the pulsating artery of the "mesocolic circle" may enable the operator to benefit the patient.

I have designated the arterial fields (areae arteriacae) as I, II, III, IV, see figure 55. The practical arterial renal fields are I and III. The arterial fields marked II and IV are those of the transverse mesocolon, and the fourth field produced by an accessory transverse artery. Mobile circles are of little practical value in peritonotomy except to mark the boundaries of vascular arcs which should be not ligated or clamped. See figures (38) (50) (54) (55) (57) (59) (62).

The branches of the proximal and distal mesenteric arteries form characteristic arches on the dorsal wall which circumscribe definitive or independent field. The arterial arches project the peritoneum ventralward and in this fold may be felt the pulsating artery. These arterial fields are so arranged that positional relations of viscera may be established and a knowledge of the arterial field may be utilized for localization of viscera during poritonotomy. Arterial fields are only of practical worth on the dorsal abdominal wall. The arterial fields (arches) are of less practical value in the areas of mesenteries of maximum length and mobility. However, the "ileocolic circle" and the "Enterocolic circle" will always demand the most careful respect in intestinal surgical procedures. They are arterial fields of practical importance. If the colon transversum be reflected proximalward the great field of the "Enterocolic Circle" or (Riolan-Haller arch) is visible—the right, the lesser, and the left the greater, see figs. (23) (27) (28) (38) (41) 42). The arterial field of the "Enterocolic Circle" may be reduced, divided if an arteria transversa accessoria be present. The artery of Waldeyer is sufficiently frequent to consider it constant in surgical procedures. The left side of the "Enterocolic circle" or Riolan-Haller arch is the arterial field which concerns the distal mesenteric artery, it is the renal field, area renalis sinistra. In my opinion the left renal and right reno-duodenal fields are the only ones of practical value among the "Major mesocolic circles." Professor Wm. Waldeyer, the prince of applied anatomy in Germany, adds the ureteral, area ureteric sinistra, however I am unable to view it as of much practical value during peritonotomy. The arterial fields are the most pronounced in space in infants. In the left renal field may also be found not only the left kidney but the adrenal, a large segment of the ureter, a portion of the gastrium, pancreas and spleen. The sigmoid arches present no recognizable established arterial field. Frequently the left renal arterial field includes the distal portion of the kidney only, especially in adults.



DUCTUS HEPATICUS, ARTERIA HEPATICA, VENA CAVA.

Fig. 73. This illustration represents the relations, dimension, bifurcations, angulations, constrictions and dilatations of ducts and arteries of the liver.

Observe that the gastric artery (G. A.) emits a branch to the left liver lobe, but does not replace the left hepatic artery. Note that the common trunk (H. A.) of the gastro-hepatic artery bifurcates prematurely.

C. A., coeliac axis.

S. A., arteria splenica.

In general the right hepatic artery is double the dimension of the left. In this subject, on account of the large dimension of the left liver lobe, the left hepatic artery is considerably larger than the right. The hepatic ducts present the same proportional dimensions.

In this subject there is a strong hepato-gastric branch supplying the lobus hepaticus sinistra—an important artery in gastrectomy. Arteria hepatica dextra courses dorsal to vena cava ductus choledochus communis and ductus regurgitate cysticus.

Hepatica ducts and arteries course practically in identical channels and sheaths.

In maximum arterial fields with minimum panniculusadiposus the center of the field may be so depressed that it appears like an inverted dome. The peritoneal border of the arterial field appears markedly projected, like a ring, with the artery coursing in its circumferential fold which in pronounced spare subjects produces the appearance that the artery possesses a kind of mesoangium. The arterial fields, areae arteriacae, may not be observed only but palpated also. I shall not include the "ileocolic circle" in "Arterial Fields" or in the "Major mesocolic circles," because it belongs to the combined ileum and colon, also the "ileocolic circle" is such a primordial prominent vascular landmark, and such a typical "inosculation circle," that it should be considered separate and independent—a con-

stant structure, a constant location of supreme vascular importance—a standard structure, for adjacent, anatomic vascular arrangement, and an "*inosculation circle*" of vast physiologic importance. The stimulation of its automatic, specialized, peripheral ganglia (Auerbach's and Billroth-Meissner's) produces dilation of its vessels.

A few brief remarks will be here presented on what I shall designate the 4 arterial fields, or "Major mesocolic circles" of the proximal and distal mesenteric arteries.

I. THE RIGHT DISTAL "MAJOR MESOCOLIC CIRCLE."

The right distal mesocolic arterial field. The reno-duodenal arterial field.

The right distal "*Major mesocolic circle*" or arterial field is located in the right distal quadrant of the dorsal abdominal wall, see figures (26) (28) (36) (38) (41) (45) (47) (50) (55) (59).

The right distal "Major mesocolic circle" is composed of the jejunal artery and the ileocolic artery, (left side) with the ramus colicus (distalward) and the right colic artery (proximalward). The right circumference consists of the inosculation of the distalward bifurcation of the right colic artery and ramus colicus (of the ileocolic artery).

The distal right "Major mesocolic circle" is an arterial field of constant location and structure. Its location is to the left of the right colon and to the right of the jejunal and ileocolic arteries, on the right dorsal abdominal wall. It is a vascular ring, a mesocolic arterial field.

In spare subjects its well injected arteries are plainly observable—projecting the peritoneum on the dorsal abdominal wall.

The *form* of the distal right "Major mesocolic circle" is variable. In general it is quadrilateral.

The *dimension* presents considerable proximo-distal variations, especially in its diameter on account of the presence or absence of an independent right colic artery.

The *contents* are the duodenum, kidney, the proximal portion of the ureter, the vasa spermatica course through this arterial field. Frequently the horizontal portion of the duodenum lies within it. Occasionally the middle segment of the right colon may project into the right distal "Major mesocolic circle," however the relation of the "straight terminal vessel" is unchanged, see figures, (41) (43) (47) (62) (64).

Frequently numerous coils of the enteron lie on the peritoneum within the right distal "mesocolic arterial field." The psoas muscle and quadrates lumborum muscle form its floor.

The surgical procedures, the distal right "Major mescolic circle" or mesocolic arterial field is especially concerned with the right colon, and to a less extent with the coecum and appendix. In operations on the right colon, the right circumference of the right distal "Major mesocolic circle" should not be clamped or ligated. Slight blunt dissection will freely expose ample length of the "straight terminal vessel" for ligation or clamping, insuring the right colon from the jeopardy of lack of blood supply and consequent ulceration or gangrene.

The form, dimension, and consequently the contents of the reno-duodenal arterial field, area reno-duodenalis depends on the existence and relations of the right colic and transverse colic arteries.

The importance of the field is due to its contents, viz; the second portion of the duodunum and part or all of the right kidney with the proximal end of the ureter.

An observation of anatomic text books for a century practically agrees with these views, see Muenz (1821), Bourgery and Jacobs, (1830), Tiedeman, (1822), R. Quain (1830), Weber (1845), Cruveilhier (1825), Wilson (1844), Henle (1876), Gegenbauer (1888), Toldt (1900), Spalteholtz, (1898), Waldeyer (1900). In fact the illustrations of anatomic text books practically are a unit, as to location.

X-RAY OF DUCTUS PANCREATICUS ET DUCTUS BILIS WITH VENA PORTAE.

Fig. 74. The relations, bifurcations, angulations of ducts and veins may be observed. The portal vein branches at right angles.
The hepatic artery must assume identical routes.

contents and relations of what I term, the *Distal right "Major Mesocolic circle"* or right distal mesocolic arterial field.

II. THE RIGHT PROXIMAL "MAJOR MESOCOLIC CIRCLE."

Right Proximal Mesocolic arterial field.

If the transverse colon be reflected proximalward two arterial fields are visible —a right smaller and a left larger field, see figures (45) (46) (47) (54) (55) (58) (59).

The right smaller arterial field is the right proximal "Major mesocolic circle" which is characterized by multiplicity of cross bar arteries and consequent multiplicity of arches. The right proximal "Major mesocolic circle" is the right segment (third) of the "Entero-colic circle" or the Riolan-Haller Arch.

The *boundary* of the right proximal "Major mesocolic circle" consists of the jejunal artery (leftward) the right colic artery, (distalward), the transverse colic artery (proximalward). The lateral or distal circumference consists of the inosculation branches between the right and transverse colic arteries, see figures, (35) (37) (38) (42) (45), for typical illustrations. Practically the right proximal "Major mesocolic circle" is bounded by the inosculation of the right and transverse colic arteries.

The *contents* of the right proximal "Major mesocolic circle" or arterial field are the caput pancreaticur, pars descendens, duodeni, Flexure duodenalis proxi-

mal, vena partae, biliary ducts, the right quatrant of the transverse mesocolon, the circle or field frequently contains multiple arteries and accumulations of arches.

The *form* of the mesocolic arterial field is irregular, mainly oval, corresponding with the form of the flexure coli hepatica.

The *dimension* of the right proximal "Major mesocolic circle" is quite variable, depending on the relations and conditions of the right and transverse colic arteries with coalescent trunks of right and transverse colic arteries the proximal right "Major mesocolic circle" is limited in dimension.

Relations. The right proximal "Mesocolic circle," or the arterial field the smaller of the two proximal major mesocolic fields is mainly related to the hepatic flexure of the colon. It is a part and parcel of the "Entero colic circle" or the Riolan-Haller arch. It relates itself intimately to the caput pancreaticus, flexure coli, pylorus, vena portae, biliary ducts, flexure duodenalis, proximal, pars descendens duodeni. During operations on its periphery, (i. e. the region of the hepatic flexure of the colon) the "Straight terminal vessel" which is of ample length (½ to 2 inches) and should be ligatured or clamped without compromising the main circumference of the circle. The right proximal "Major mesocolic" is a mobile apparatus, unlike its distal and adjacent relative which is immobilly fixed on the dorsal abdominal wall. It demands respect in all surgical procedures on the right and transverse colon, on account of the jeopardy of obstructing its periphery—endangering colonic ulcerations or gangrene.

The superimposed minor arches on the proximal right and left "major mesocolic" are perhaps equal in frequency of occurrence.

III. LEFT PROXIMAL "MAJOR MESOCOLIC CIRCLE."

Left Renal Field, (Area renalis sinistra). Left mesocolic arterial field.

With the transverse colon and mesocolon reflected proximalward we observe on the left side the large left proximal "Major mesocolic circle" or mesocolic arterial field.

Practically the left proximal "Major mesocolic" or arterial field is the "Enteronic circle" or the Riolan-Haller arch.

The *boundary* of the left proximal "Major mesocolic circle" consists of the inosculation of the transverse colic artery and the left colic branch of the distal mesentric.

The *location* of the left proximal "Major mesocolic circle" is in the left side of the transverse mesocolon and proximal region of the left mesocolon. It is situated in the splenic flexure of the colon.

The *form* of the left proximal "major mesocolic circle," though variable. is that of an arch or ring.

The *dimension*, presents an extensive variation mainly on account of the presence or absence of an accessory transverse artery (Waldeyer's artery) the circumference may be 15 to 20 inches in length.

The *contents* of the left "major mesocolic circle," are left kidney, cauda pancreatica, corpus pancreaticus, flexura duodenalis, adrenal, vas spermatica. If no. accessory transverse artery exist this field is really the left renal arterial field.

The *relation* of the left major mesocolic arterial field is first, chiefly with the left half of the transverse colon and left colon and second with the left kidney—It is a renal field.

A significant factor in regard to the left major mesocolic arterial field is that it is frequently divided by the accessory transverse colic artery. The division of the left "Major mesocolic circle," fortifies, increases its integrity and strengthens collateral circulation, the circle of importance during surgical procedures on the colon and kidney.

During surgical procedures on the transverse and left colon the most important matter is the control of and management of the blood vessels.

The "straight terminal vessel" on the periphery is of ample length for ligature or clamp without compromising the main circumference of the circle.

During surgical procedure on the kidney from within the peritoneum it is the safer to reflect the left mesocolon medianward whence the "Entero colic circle" may not be ligated or clamped.

IV. LEFT DISTAL "MAJOR MESOCOLIC CIRCLE" OR LEFT DISTAL MESOCOLIC ARTERIAL FIELD.

The left distal "Major mesocolic circle" depends on the presence of the accessory transverse colic artery, hence it is practically a substitute due to the presence of Waldeyer's artery. When it exists it is the left renal arterial field.

The presence of Waldeyer's artery is sufficiently frequent to demand attention. With the presence of Waldeyer's artery the left distal "Major mesocolic circle" is formed by the inosculation of the left colic branch (from the distal mesenteric) with the accessory transverse colic artery which forms an arterial field.

I refer for the view of the left distal "Major mesocolic circle" to figures (55) (58) (59), each presenting the presence of an accessory transverse colic artery (Waldeyer's artery). Figures (55) and (58) are the typical illustrations for reference and will serve for reference in describing this mesocolic circle.

Boundary. The left distal "Major mesocolic circle" or distal major mesocolic arterial field is bounded by the accessory transverse colic artery (Waldeyer's artery) and the left colic branch of the distal mesenteric artery. The circumference is distinct.

Dimensions. The dimensions of the circle is considerable extending from the pancreas to the ilea crest and from the aorta to the left colon. The circle may be divided by cross bar arteries as in figures 55 and 58.

Form. The form in general is quaderlateral.

Contents Practically is a renal arterial field. It includes adrenal, kidney, proximal ureter. It is increased by the spematic or ovarian vessels. Numerous coils of enteron and in some 15% of sigmoids lie in it on the peritoneum.

Relation to kidney. As in figures 55 and 58 (it is a renal field) the kidney could be extirpated ventrally through the peritoneum without jeopardizing the colon to ulceration or gangrene. However, the general safety of the patient is conserved by reflecting the left colon and its mesocolon medianward during surgical procedures on the kidney.

Conclusions Regarding the "Major Mesocolic Circles" or Mesocolic Arterial Fields.

Figures (33) (34) (35) represent with the major mesocolic circle the absence of an accessory transverse colic artery (Waldeyer's artery).

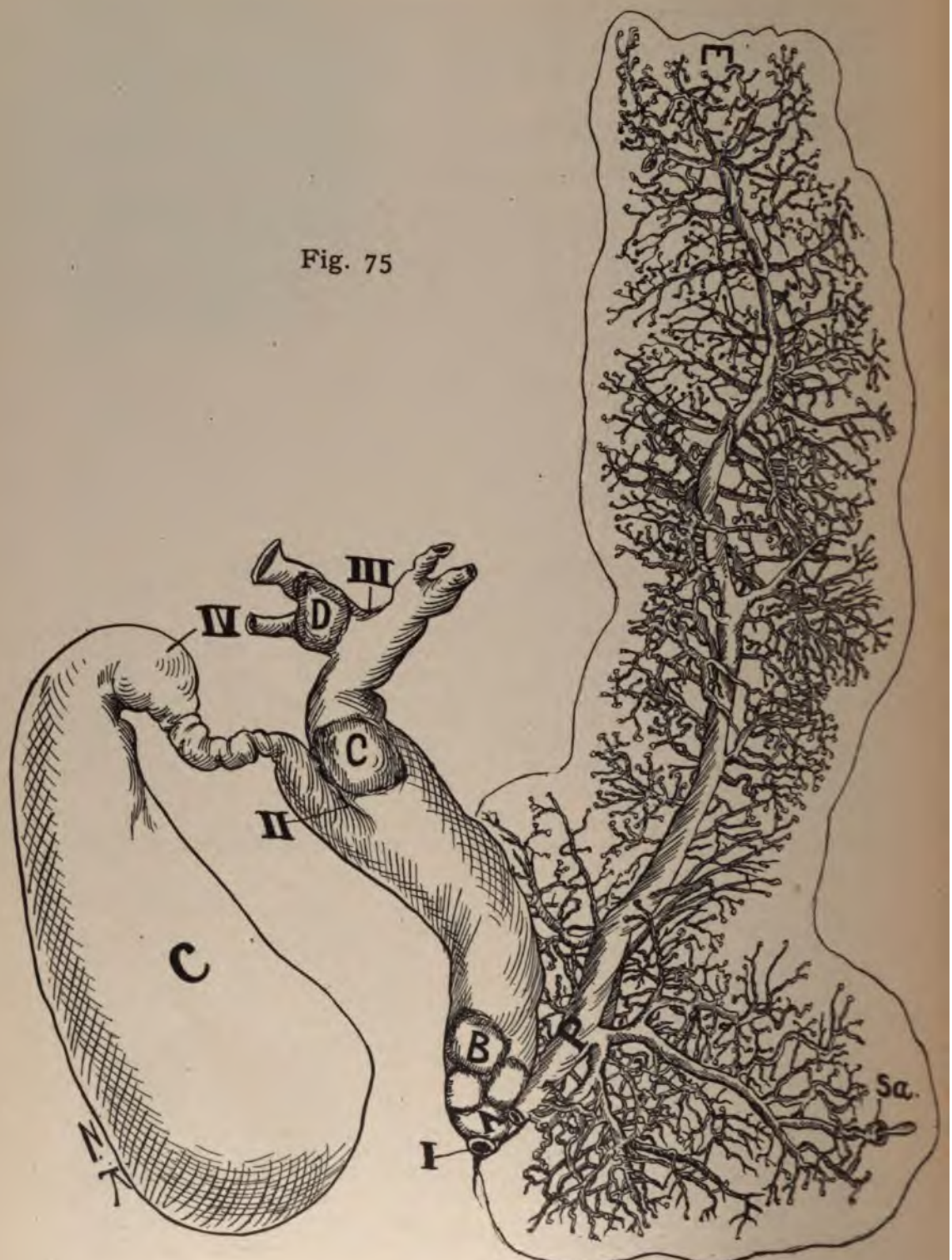
Figure 55 and 58 represent the major mesocolic circles with the presence of an accessory transverse colic artery (Waldeyer's artery).

In addition to the "ileocolic circle" which is partially mesocolic, there are 4 "Major mesocolic circles" or major mesocolic arterial fields, viz: I *Right distal "Major mesocolic circle,"* II. *Right proximal "major mesocolic circle,"* III. *Left proximal "Major mesocolic circle"* IV. *Left distal "Major mesocolic circle."* The 4 "Major mesocolic circles" are formed by the inosculation of the branches of the proximal and distal mesenteric arteries. The major mesocolic circles are characterized by the formation of definitive visceral boundaries, producing.

The major mesocolic circles form prominent arterial fields, on the dorsal abdominal wall which circumscribe viscera and form marked visceral boundaries.

The "Major mesocolic circles" are arranged in established relations with viscera. The most important "Major mesocolic circles" are the right reno duodenal field and the left renal field. Conditions may arise during peritonotomy

Fig. 75



X-RAY OF DUCTUS PANCREATICUS AND PART OF DUCTUS BILIS.

Fig. 75. I secured this remarkable specimen from an autopsy through the courtesy of Prof. W. A. Evans.

There are 4 hepatic calculi forcing a dilatation of Vater's papilla sufficient to allow septic material to regurgitate into the pancreatic duct. Marked ulceration existed in Vater's papilla. One calculus was located in the ductus hepaticus communis and one was located in the ductus ramus dextra.

from abscess distorting visceral relations or excessive fat where palpating the pulsating artery of the "mesocolic circle" may enable the operator to benefit the patient. "Major mesocolic circles" are of practical worth on the dorsal abdominal wall only—not in the mobile transverse mesocolon.

It is evident from the numerous illustrations accompanying this monograph that the "Major mesocolic circles" are variable in form, dimension, and to a less extent in location.

It is evident they circumscribe definitive, arterial fields and form visceral boundaries, perhaps the chief mesocolic arterial fields are the right and left renal.

SECTION IV.

APPLIED ANATOMY AND PHYSIOLOGY OF THE "INOSCULATION CIRCLE."

Blood Cures Disease.

My subject is the control of the blood volume.

My theme is the "inosculation circle" and the means by which therapeutics influence it.

The volume of blood in the "inosculating circle" is controlled by the stimulation of their automatic specialized peripheral ganglia.

The apparatus for executing visceral hyperaemia is the inosculation circle.

The means of functionating the "inosculation circle" is by stimulating its automatic specialized peripheral ganglia which dilate its vessels and engorges the peripheral viscus.

An "inosculation circle" consists of a vascular arc, a peripheral viscus and automatic specialized peripheral ganglia.

The object of an "inosculating circle" is to engorge its peripheral viscus and transport blood volume from one viscus to another.

A maximum volume of blood occupying an "inosculation circle" initiates common visceral function (sensation, absorption, secretion, peristalsis).

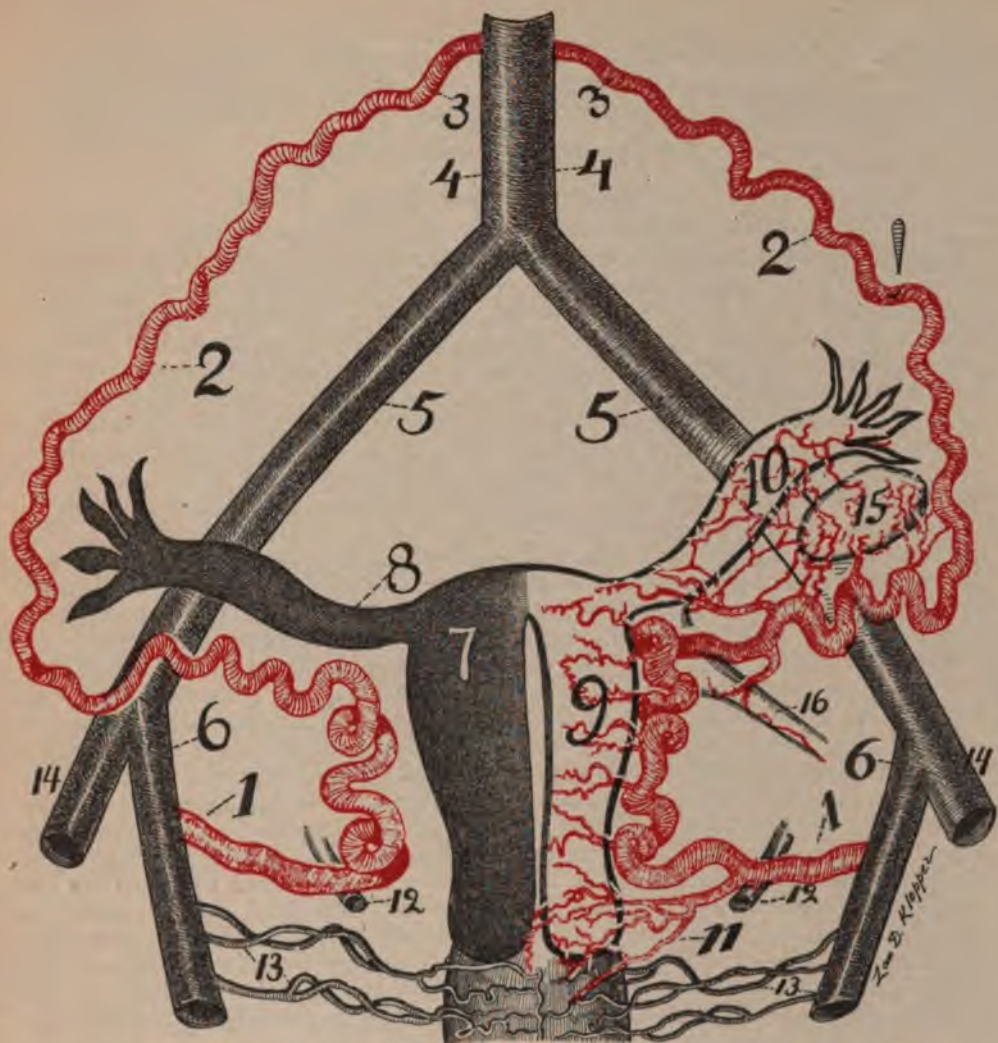
The rational therapeutics of the "inosculation circle" is *Visceral Drainage* (i. e. the administration of ample fluid and food at regular intervals) which produces maximum visceral hyperaemia and maximum visceral elimination.

The text book of anatomy teaches the student a single "inosculating circle," viz: that of Thomas Willis (1622-1675), the English anatomist who was professor in the University of Cambridge. The circle of Willis is located at the cerebral base and though from neglect of investigation it has presented slight influence to therapeutics it has maintained undisputed anatomic distinction for almost two and a half centuries.

The great crux, the base and rock of circulation is the "inosculation circle" or arc, the anastomotic union of vessels. The "inosculation circle" is the line of least resistance to blood current. The most universally applicable therapeutic agent for the cure and prevention of disease is the control of blood volume and this control may be excerised through the "inosculation circle" by means of influencing its automatic specialized peripheral ganglia.

I shall present in this brief paper some of the prominent "inosculation circles" and the means of influencing their blood volume.

The great "inosculation circles" are mainly related to important viscera, e. g., Cerebrum (circle of Willis), genitals (utero-ovarian Circle), gastrium ("Concentric-gastric circles") ileocoecal apparatus (ileocolic circle), Enteron and colon (Entero-colic circle), duodenum and Pancreas (duodenal circle, Pancreatic circle). The inosculating by arterial loops, the capacity of arteries for indefinite enlargment and the fact that the arterial "inosculation circles" are imposed, surmounted by automatic specialized peripheral ganglia which influence the caliber of the artery composing the circle, places in the hands of the physician a vast power over disease. Utilizing the "inosculation circle" for therapeutic purposes is exactly similar to what earlier surgeons accomplished by ligature (for aneurism) with consequent increased collateral circulation. The number of termination arteries in an organ, the rate of blood current and volume



THE UTERO-OVARIAN ARTERY—THE CIRCLE OF BYRON ROBINSON.*

Fig. 76. 1, 2, 3, utero-ovarian artery—the spiral segment of the genital vascular circle; 5, the common and 6 the internal ileac—the straight segment of the genital vascular circle. The utero-ovarian artery is a typical "inosculation circle" composed anatomically of—(a), a vascular arc, (b), automatic, specialized peripheral ganglia, (c), a peripheral viscus. Physiologically its function is to congest its peripheral viscus (genitals).

The (genital) "inosculation circle" is functionated by stimulating its peripheral ganglia (automatic menstrual ganglia), ganglion cervicis (Pelvic brain), which dilate its vessels (utero-ovarian artery) and hyperaemize its peripheral viscus (genitals).

The condition or means of stimulating the genital "inosculation circle" are—menstruation, copulation, gestation, hot douche, massage, tampton, electricity.

*Dr. Wm. E. Holland—American Journal of Surgery and Gynecology, December, 1900.

of blood to an organ determines its functional activity. Since many important organs, (genitals, lungs, stomach, ileocoecal apparatus), possess an "inosculation circle" of distinct, marked character and with distinct marked automatic specialized peripheral ganglia control of blood in the "inosculation circle" will be one of the most universally applicable therapeutic agents.

The therapeutic accessibility of the main "inosculation circles" is practical

that its right circumference (i. e., the ileocolic artery) is the main source of the origin of the arteria appendicularis which alone will immortalize it.

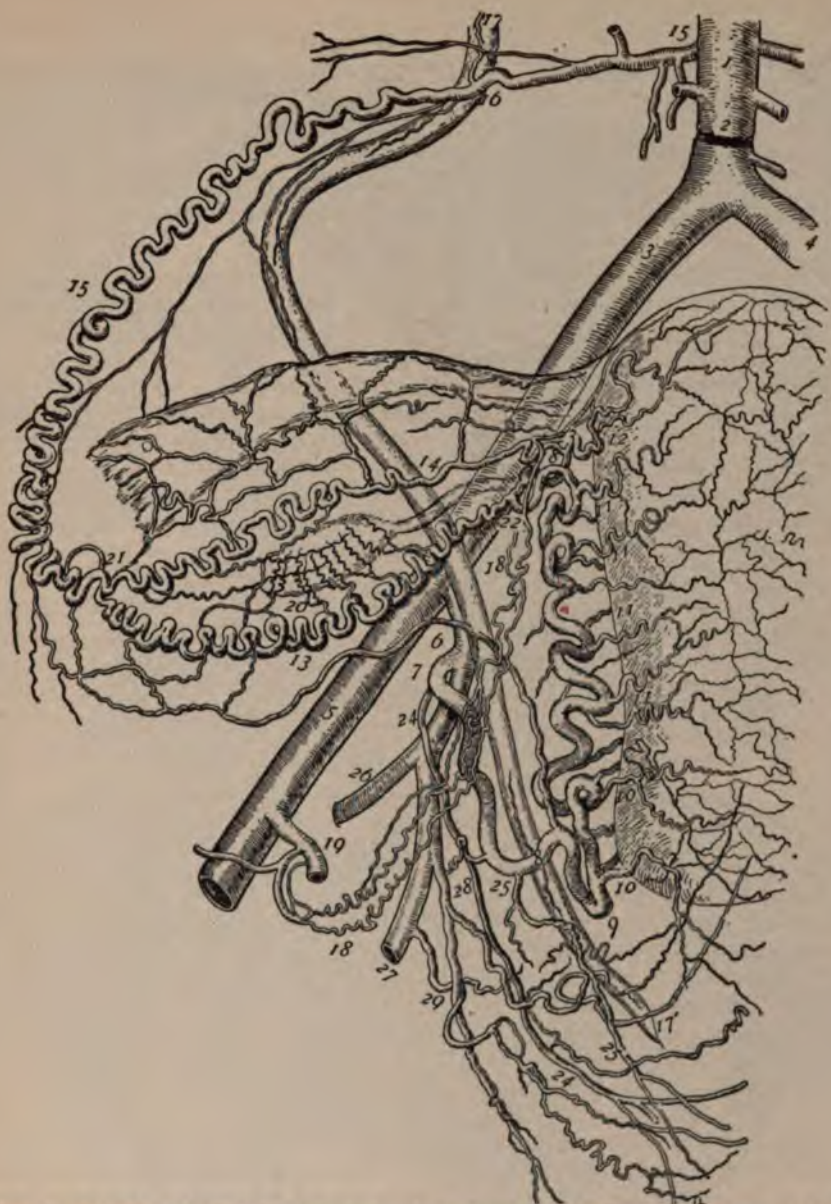
The circle existing in the form of an oval measures frequently 2 by 6 inches The dimension of the "ileocolic circle" depends upon the location of the bifurcation of the jejunal artery. The jejunal artery may bifurcate proximal, on a level or distal to the origin of the distal mesenteric artery. The "ileocolic circle" may possess, imposed on its periphery a series of minor vascular arches. The "ileocolic circle" is a primordial vascular landmark destined to nourish the ileum and cecum with the appendix as an ancient stomach). The "ileocolic circle" is associated and in relation with the right psoas, distal, ileum, cecum, ureter, common iliac, and the treacherous, dangerous appendix to which it primarily, chiefly and directly emits the vascular supply. It is directly associated with the "ileocolic arches."

The "ileocolic circle" possesses, imposed, surmounted on its periphery automatic specialized ganglia (known as Auerbach's and Billroth-Meissner's) with influence the caliber of the artery composing the circle (see figures 36, 42. 45. The therapeutic problem as regards the "ileocolic circle" is the means of stimulating the automatic, specialized peripheral ganglia in order to influence the blood current. The control of blood current and volume in the "ileocolic circle" would aid in curing those prevalent diseases, viz., (a) peritphlitis, (b) meso-appendicular adhesions, (c) ileal disease (tuberculosis, typhoid ulceration). Practically the cause of the majority of cases of perityphlitis is trauma of the psoas muscle inducing germs or their products to migrate through the appendicular muscosa, musularis and serosa causing periappendicular peritoneal adhesions, (meso-peritphlitis which compromise the appendicular blood vessels and flexes, the appendix, checking appendicular drainage).

If the blood current and volume of the "ileocolic circle" could be controlled, concentrated, increased by therapeutics, the meso-appendicular adhesions would absorb, dissolve whence the compromised meso-appendicular vessels would be released and the flexed appendix would enjoy ample drainage. By cathartics a partial congestion of the "ileocolic circle" is accomplished, however insufficiently intense and persistent to absorb, completely compromising peritoneal adhesions. However, it may be hopefully expected that therapeutics will discover a method of controlling the blood current and volume of the "ileocolic circle" and consequently of not only curing but furnishing a prophylaxis for perityphlitis, ileal tuberculosis, typhoid ulceration.

For 20 years I have practiced what I term "visceral drainage" which signified e. g. that the common functions of the tractus intestinalis and tractus urinarius (sensation, secretion, absorption, peristalsis) should be maintained at a normal activity.

"Visceral drainage" is accomplished by administering at regular intervals (say before and between meals) definite quantities of fluid, food and intestinal irritants to maintain the normal functions. In other words, "Visceral drainage" stimulates Auerbach's and Billroth-Meissner's plexuses, i. e., the automatic, specialized peripheral ganglia of the "ileocolic circle" sufficiently to entice ample blood not only to maintain function but to prevent disease, to be a prophylaxis to disease in the ileocolic structures and especially the appendix. If the appendix, ileum, cecum are to be maintained in normal health a normal quantity of blood must flow through the "ileocolic circle." Constipation may be cured by maintaining a normal quantity of blood. The "ileocolic circle" is the agent by which an abundant, continuous blood volume is furnished to the coecum, appendix and ileum and also provides a maximum vascular apparatus, in case of embolism or local obstruction, for maximum, collateral circulation. The therapeutic agents by which the automatic, specialized peripheral ganglia of the "ileocolic circle" are stimulated are practically similar to those of the genital vascular circle. The "ileocolic circle" is a typical "inoculation circle" and posseses the



THE GENITAL VASCULAR CIRCLE—A TYPICAL "INOSCULATION CIRCLE."

Fig. 78. This illustration was drawn from a dissection which I made from a 3 month's pregnant uterus.

6 to 9 pelvic floor segment of utero-ovarian artery.

9 to 22 uterine segment.

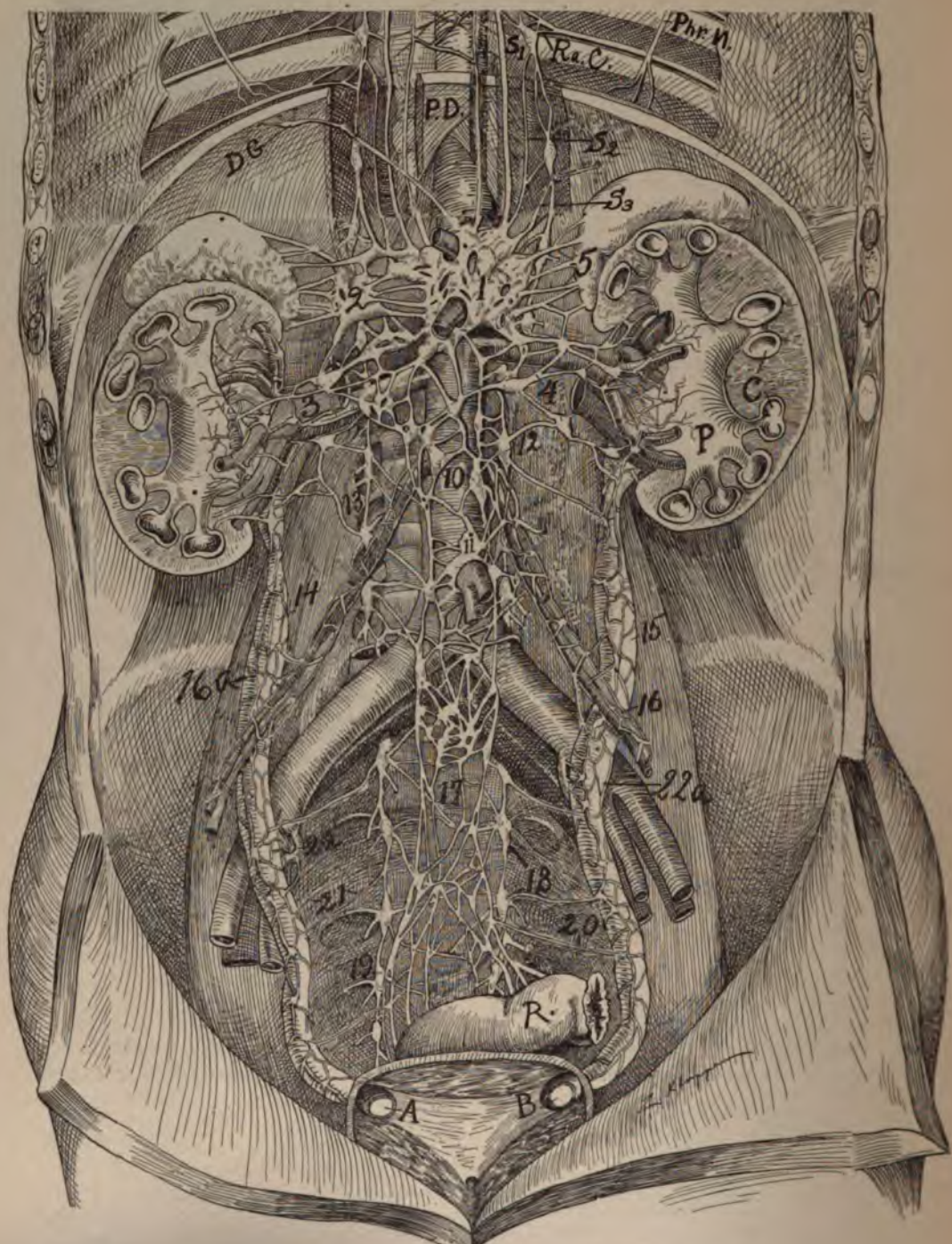
22 to 21 oviductal segment.

21 to 15 ovarian segment.

(22, 14, 21) and (22, 13, 21) "ovarian vascular circle."

8, 9, 10, a typical "cervical loops."

The utero-ovarian circle, the genital vascular cirle—a typical "inosculation circle" consists anatomically of (1), a vascular arch; (2), automatic peripheral ganglia (automatic menstrual ganglia, pelvic brain; (3) aperipheral viscus (genitalis); physiologic, the genital "inosculation circle" is to congest its peripheral viscus—the genitals—for the purpose of initiating common visceral function (sensation, secretion, absorption, peristalsis) or special visceral function (ovulation, menstruation, gestation). Stimulation of the automatic peripheral ganglia of the genitals dilates the vessels of its "inosculation circle."



ABDOMINAL BRAIN—CEREBRUM ABDOMINALE, PLEXUS AORTICUS, PLEXUS RENALE.

Fig. 79. This illustration is from a dissection made under alcohol. It is a drawing from a subject possessing a typical large abdominal brain with the ureter, bladder and urethra

dilated into a single channel without sphincters intact. 1 and 2, abdominal brain; 3 and 4, renal plexuses; 5, plexus adrenalis; 6 and 7, the two vagi; 8 and 9, the three splanchnics on each side; 10, two spermatic ganglia; 11, inferior mesenteric ganglia; 12 and 13 lumbar lateral chain of ganglia; 14 and 15, dilated ureters wrapped by nerve plexuses; 16 arterio-ureteral crossing; 17, hypogastric plexuses; 18 and 19, lateral chain of sacred ganglia; A and B, Patulous ureteral orifices. The Plexus aroticus extends from the abdominal brain (1 and 2) to the aortic bifurcation, whence the Plexus interiliacus (hypogastricus) begins and extends to the Pelvic brain. I consider the Plexus Aorticus in this subject as a typical one.

This exposition of the nervous vasomotorius demonstrates the source of innervation of the common visceral function (sensation, secretion, absorption, peristalis) and special visceral function (ovulation, menstruation, gestation). The nervous apparatus of the tractus intestinalis cannot be separated from the tractus vascularis or its peripheral viscera.

capacity to engorge its peripheral viscera (ileum and coecum) but transports blood volume from one viscus (ileum) to another (coecum).

An object of the "ileocolic circle" is to maintain a maximum volume of blood flowing to its peripheral viscera with maximum collateral circulation for physiologic function (sensation, secretion, absorption, peristalsis).

4. The Ileocolic Arches.

The "ileocolic arches" located in the ileocolic angle, formed by the anastomsis of the dorsal and ventral ileocolical arteries are so intimately associated and dependent on the condition of the "ileocolic circle" that a discussion of their applied physiology is not necessary. The "ileocolic arches" are immortalized from the fact that they frequently (95 per cent.) originate appendicular arteries. However, the applied physiology of the "ileocolic arches" is mainly merged in that of the "ileocolic circle."

5. The "Concentric Gastric Circles."

There is a proximal and a distal gastric circle. (a) *Proximal gastric circle or gastrohepatic circle,* the lesser of the two "concentric gastric circles" is formed by the anastomosis of the gastric and hepatic arteries, and the circle is completed by the arteria hepatica communis (common trunk of the hepatic and gastro-epiploic arteries). The circle is located along the lesser gastric curvature. The proximal gastric circle may measure 10 inches in circumference.

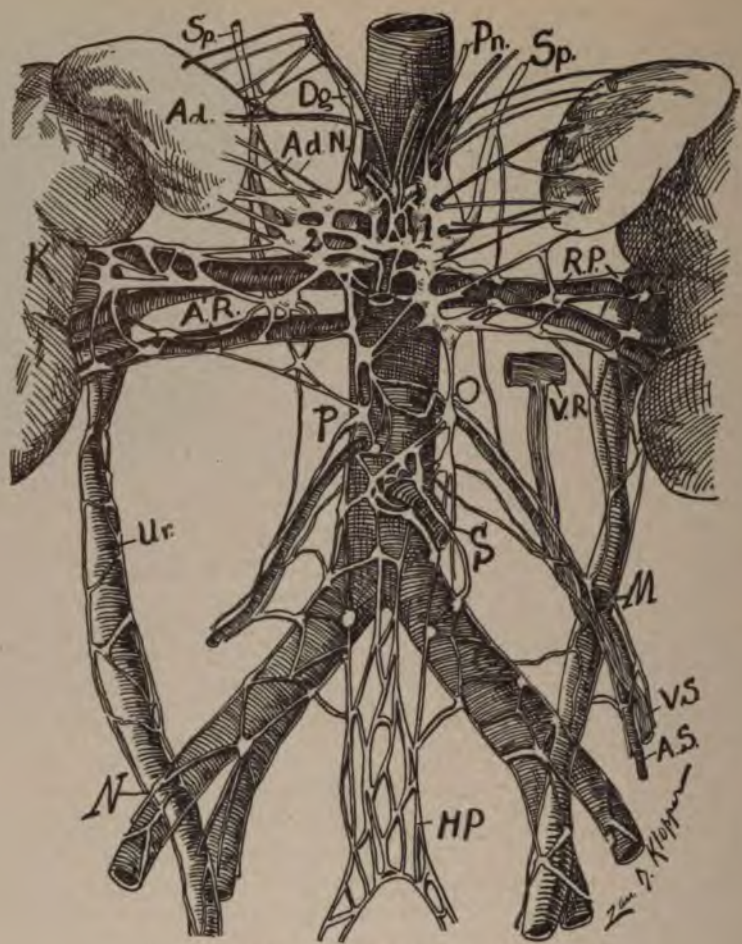
(b) *Distal gastric circle or hepatosplenic circle,* the greater of the two "concentric gastric circles" lying along the greater gastric curvature is formed by the anastomosis of the gastro-epiploica (sinistra and dextra) and completed by the hepatic and splenic arteries. The distal gastric circle may meaure 20 inches in circumference.

The gastrium practically lies between the two "concentric gastric circles" and in gastrectomy a ligature is required at the right and left end of the gastric and gastro-epiloic arteries.

The "concentric gastric circles" are of supreme importance in the field of applied physiology. An evacuated stomach is a contracted pale organ in quietude with its functions (sensation, absorption, secretion, peristalsis) in abeyance. An occupied stomach is one engaged with blood, congested. Its functions (secretion, sensation, absorption, peristalsis) are in vigorous action. The concentric gastric circles (composed of the gastric and gastro-epiploic arteries) possesses imposed on their periphery automatic, specialized ganglia, (Auerbach's and Billroth-Meissner's) which influence the calibre of the arteries composing them.

Through aeons of ages the automatic specialized peripheral ganglia located along the concentric gastric circles have become developed into a physiologic automaton of wondrous power and precision.

There is a profoundly marked difference between the stomach in quietude and in maximum functional activity. The functionally active stomach is profoundly



ABDOMINAL AORTIC PLEXUS.

Fig. 80. This illustration represents a typical aortic plexus, which I dissected, under alcohol from a specimen taken from a subject of about fifty years of age. 1 and 2 abdominal brain lying at the foot of the great abdominal visceral arteries. P. O. S. ganglia located at the other visceral arteries. HP. represents the fenestrated interiliac nerve disc.

This sketch from dissection presents distinct visceral ganglia at the root or emergence of each important abdominal viscus e. g. note the prominent ganglia located at the root of the coeliac axis, the proximal mesenteric artery, the distal mesenteric artery, the renal artery.

The ganglia located at the root or emergence of the abdominal visceral arteries are the apparatus which initiates, maintains, subsides the peripheral visceral function by controlling blood volume.

engorged, the lumen of the concentric gastric circles are markedly distended and especially the distal concentric gastric circle (the gastro-epiploic artery) presents maximum peristalsis, violent pulsations. In spare subjects the phenomenal pulsations of the gastro-epiploic artery during gastric digestion may communicate vigorous motion to the abdominal wall. The therapeutic agents by which the automatic specialized peripheral ganglia of the "concentric gastric circles" may be influenced, stimulated with consequent dilation or distention of the gastric and gastro-epiploic arteries, is practically the same as those employed on the genital vascular circle, viz., heat, electricity, massage and functionation due to food and fluid (equivalent to the functionation due to menstruation and gestation in the

genital tract). There is no "inosculation circle" in the body (except the genital vascular circle) which can be so profoundly changed regarding blood volume, as the "concentric gastric circles." This remarkably manifest physiology is mainly produced by fluid or food. In pathologic states of the stomach the "inosculation circles" are extremely valuable therapeutically. For example, in gastric ulcer active administration of the appropriate food stimulates the automatic specialized ganglia located along the periphery of the gastric circles with consequent engorgement of the same, and secondary flooding of the gastric parieties and ulcer with blood—since blood cures disease the gastric ulcer is practically liable to disappear.

The starving plan for the cure of gastric ulcer is irrational. The automatic specialized peripheral ganglia of the "concentric gastric circles," are lulled into hibernation by lack of fluid food stimulation. The ultility of the "concentric gastric circles" in controlling blood supply or the physiology of the stomach is evident in gastric pathologic states. In acute gastric inflammation the gastric circles may be maintained in quietude in physiologic rest, by withholding food or fluid which may be administered vicariously per rectum. The benefit derived from gastro-enterostomy, for gastric carcinomia, is due to the prevention of gastric congestion—the gastric circles do not perform their periodic cycles of congestion and decongestion, of engorgement and depletion, the automatic specialized peripheral ganglia of the gastric circles are placed at rest.

The "concentric gastric circles" are typical "inosculation circles" with the capacity of peripheral visceral engorgement and transportation of blood volume from one viscus to another.

6. The "Entero-Colic Circle."

(Arcus mesocolicus or Riolan-Haller arch.)

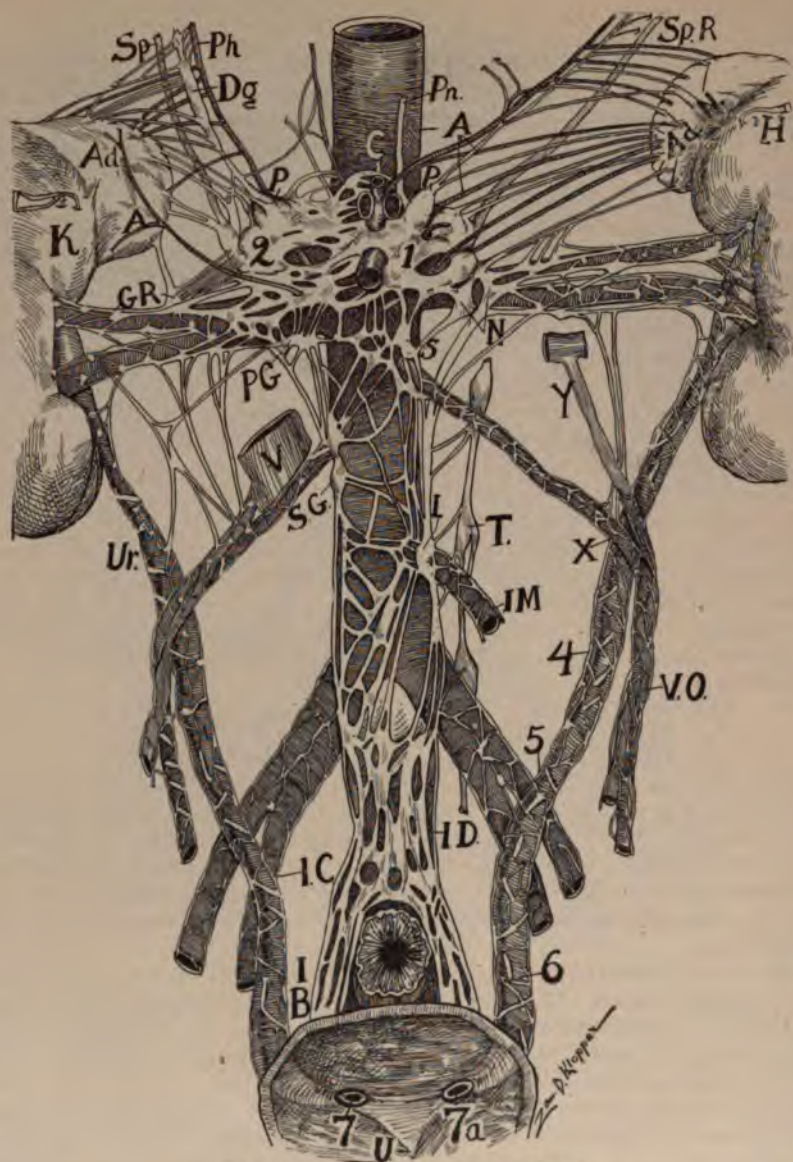
The "enterocolic circle" (arch) is the means by which the blood vessels of the enteron are directly connected with the blood vsssels of the colon (see figures 45, 23, 38, 47, 62, 57). The entero-colic inosculating loop connects directly the jejunal artery with the distal mesenteric artery. The entero-colic circle, located in the mesocoon possesses a circumference of some 18 inches in length. It is composed by the inosculation of the arteria mesocolica transversa and the arteria mesenterica distal.

Jean Riolan (1580-1657), French anatomist described it, receiving an eponym and Albert Haller (1708-1777) the Swiss anatomist described it, receiving an eponym, hence I term it the Riolan-Haller arch.

The "entero-colic circle" is one of the maximum arches of the body, measuring some 18 to 20 inches in length.

The "Entero-colic circle," the Riolan-Haller arch, or arcus transversus colicus, is formed by the inosculation of the transverse mesocolic artery (from the jejunal artery) with the left colic artery (from the distal mesenteric artery). The entrocolic circle forms a powerful connection between the proximal and distal mesenteric arteries forming a solid and compact "inosculation circle," anastomosis, between the enteron and colon with capacity of immediate transportation blood volume from enteron to colon as necessity requires.

The Riolan-Haller arch is frequently, (to its advantage interrupted by an accessorory colic artery, arteria transversa accesoria, or what I have termed *Waldeyer's artery*. It is of extreme practical significance in surgical procedures on the intestines that the Riolan-Haller arch be not ligated or interrupted as it may jeopardize the colon to ulceration or gangrene. The "enterocolic circle" may possess imposed on its periphery or circumference a series of minor arches. *Waldeyer's artery* makes more solidly and compactly the circulation of the transverse colon increasing collateral circulation. The extreme length of the "entero-colic circle"—20 inches—endangers peripheral circulation by obstruction, embolus. Multiple arteries produce multiple vascular arches which make doubly s[illegible], ample



PLEXUS AORTICUS ABDOMINALIS.

Fig. 81. This illustration presents the sympathetic nerves following the arteries. I dissected this specimen (man 40) with care and the artist, Dr. Klopper, sketched exactly from the model. 1 and 2, abdominal brain. Pn, Pneumogastric nerve; sp. Nervus Splanchnics major. Ad, adrenal; Dg, ganglion diaphragmaticus; Adn, 10 adrenal nerves (right), (left), 7. G. R. arteria renalis (right and left partially duplicate). N. ganglia renalia (left). Ur, ureteral nerves. S. G. and 5 upper ganglia spermatica. I, ganglion mesentericum inferior; X, ganglionic coalescence of nerves at the vasa spermatica and ureteral crossing. 5 ganglionic coalescence of the nerves at the crossing of the ureter and vasa iliaca communis. IB, Plexus interiliacus (hypogastricus) surrounding the rectum. ID is the fenestrated nerve disc of the sacral promotory. V, Vena cava emitting the vena ovarica on which is ensheathed the plexus ovaricus.

Note the marked, ganglia located at the root of the coeliac axis (abdominal brain), the proximal mesenteric artery (abdominal brain), distal mesenteric artery, renal artery.

The stimulation of the peripheral viscus passes over the peripheral ganglia, over the fenestrated nerve sheath enclosing the visceral artery, through the visceral ganglion located at the root of the root of the visceral artery, where it is reorganized and emitted to the ganglia of the peripheral viscus.

peripheral circulation, by abundant collateral anastomosis. The "entero-colic circle" possesses on its periphery automatic specialized ganglia (Auerbach's and Billroth-Meissner's) which influence the calibre of the artery composing it.

The therapeutic agents which influence the automatic specialized peripheral gangalia (Auerbach's and Billroth-Messiner's) of the "entro-colic circle" are the various form of stimulation, viz., food, fluid, massage, electricity, environments, exercise, foods which leave liberal faecal masses.

The chief agents of value in maintaing normal circulation in the "entero-colic circle" are the administration of appropriate quantity and quality of food and fluid at regular intervals—in other words, *visceral drainage* must be maintained. Colonic injections, markedly influence the automatic specialized peripheral ganglia of the entero-colic circle and consequently the blood volume of the "entero-colic circle."

Normal blood volume must be maintained in the "entero-colic circle" in order to maintain normal function of the enteron and colon (sensation, absorption, secretion, peristalsis). Normal blood volume of the "inosculation circle" produces normal visceral hyperaemia and consequent normal visceral elimination—life's necessity. The compact and solid anastomosis existing between enteron and colon, through the "entero-colic circle," endows the enteron and colon with the automatism or power of enticing blood volume to any segment where active function is demanded (as digesting food or faecal mass).

The function of the "entero-colic circle," a typical "inosculation circle" is to engorge its peripheral viscus (the colon and enteron) and transport blood volume from one viscus (the enteron) to another (the colon).

7. The "Duodenal Circle."

Arcus duodenalis.

The duodenal circle (or arch) is the means by which the hepatic artery is directly connected with the jejunal artery (see figure 30).

The duodenal circle solidly and compactly anastomosis the stomach and enteron, it is the "inosculation circle" between the hepatic artery and the jejunal artery. The arteria pancreatico-duodenalis proximal is a branch of the arteria gastro-epiploica (dextra) while the arteria pancreatico-duodenalis distal is a branch of jejunal artery. The proximal and distal arteria pancreatico duodenalis forms the inosculation duodenal loop between hepatic artery and jejunal artery. It should be called the *pancreatico-duodenal artery* or *"duodenal circle."* It emits numerous lateral branches to the duodenum and to the pancreas in which abundant anastomosis occurs with the pancreatic branches from other sources forming what I term the "pancreatic circle." The duodenal arc or duodenal circle is inseparably connected (*anatomic and physiologic*) with the pancreatic arc or "pancreatic circle" and both "doudenal circle" and "pancreatic circle" serve the same purpose, viz., that of solidly and compactly anastomosing the coeliac axis to the jejunal artery or of anastomosing the gastrium to the intestine "gastro-enteronic circle" (arcus gastricus intestinalis).

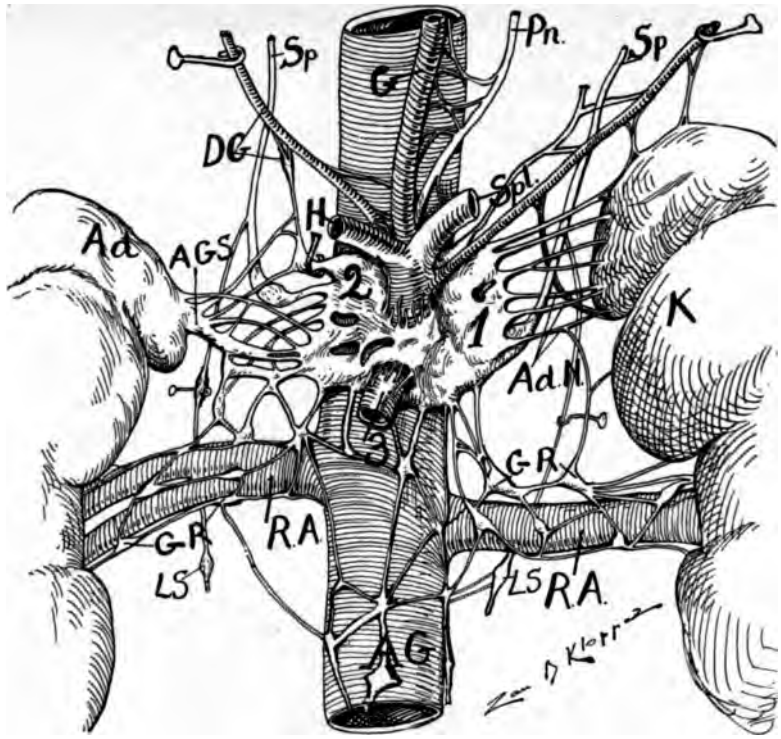
8. The "Pancreatic Circle."

Arcus Pancreaticus.

The "pancreatic circle" or pancreatic arch is the means by which the splenic artery (and gastric artery) is directly connected with the jejunal artery (see figures 57, 58, 59, 62, 64.)

The "pancreatic circle" solidly and compactly anastomoses the stomach and enteron, it is the "inosculation circle" between the splenic artery and the jejunal artery.

The "pancreatic circle" or arch is formed by branches from the coeliac axis (hepatic, splenic, gastric) and jejunal artery, which solidly and compactly anas-



ABDOMINAL BRAIN—(CEREBRUM ABDOMINALE).

Fig. 82. This illustration I dissected under alcohol. It represents fairly accurately abdominal brain of the general subject. Note the visceral ganglia located at the root of visceral arteries.

tomoses within the pancreas forming a rich anastomatic apparatus, which is intimately united with the duodenal circle—both practically serving the same purpose, i. e., solidly and compactly anastomosing the coeliac axis to the jejunal artery or anastomosing the coeliac axis to the jejunal artery or anastomosing the stomach to the intestines "gastro-intestinal circle" (arcus gastricus intestinalis). The "duodenal circle" or arc plus the "pancreatic circle" or arc act as a single circle or arc, solidly and compactly anastomosing the coeliac axis and its branches to the jejunal artery. As the "duodenal circle" plus the "pancreatic circle" anastomoses the stomach solidly to the enteron ("gastro-interonic circle" or arc) so the "entero-colic circle" (Riolan-Haller arch) solidly and compactly anastomoses the enteron to the colon ("entero-colic circle") or arc.

The solid and compact anastomosis of the arteries of the gastro-intestinal tract enables it to functionate as a vascular unit. Wherever digestion is the most ample collateral circulation allows local engorgement so that function (sensation. secretion. absorption, peristalsis) may become actively localized in any intestinal segment.

9. The "Pulmonic Circle."

The pulmonic circle is not an "inosculation circle" in the ordinary sense on account of its venous connection, however, it simulates a vascular circle and serves our purpose for Rokitansky observed that in subjects with cardiac valvular disease pulmonary tuberculosis was a rarity. The lung was congested, engorged in the apices and protected from tuberculosis. Blood cures pulmonary tuberculosis. In

short a defective regurgitating aortic valve (with consequent pulmonary hyperaemia) will cure or protect the pulmonary apices from tuberculosis.

Conclusions as Regards the "Inosculation Circle."

An "Inosculation circle" consists anatomatically of (a) vascular arc: (b) a peripheral viscus; (c) automatic specialized, peripheral ganglia. The crux, the rock and base of circulation is the "inosculation circle."

The "inosculation circle" is related to important viscera, e. g., "circle of Willis (cerebrum), "utero-ovarian (genitals), "concentric gastric circles" (gastrium), "ileocolic circle" (ileo-colic angle). "Entero-colic circle (enteron and colon), "gastro-enteronic circle" (gastrium and enteron).

Physiologically the function of an "inosculation circle" is to produce hyperaemia in its peripheral viscus and also to transport blood volume from one viscus to another.

The means of functionating the "inosculation circle" is by stimulating its automatic, specialized, peripheral ganglia which dilate its vessels and engorge its peripheral viscus. The volume of blood occupying the "inosculation circle" may be controlled by stimulation of its automatic peripheral ganglia.

The rushing current of blood to diseased parts, to infected areas is sufficient evidence that blood cures and is a prophylactic of disease and the aiblity of the physician to control the blood volume in the "inosculation circle" enables him to imitate nature. The "inosculation circle" possesses unlimited utility in medicine and presents one of the most hopeful therapeutic fields. The chief rational therapeutics for the "inosculation circle" is *Visceral Drainage* (i. e., the administration of ample fluids at regular intervals) which produces maximum visceral hyperaemia and maximum visceral elimination. Finally:

A cell lives in water.

A cell functionates in a fluid medium.

The apparatus for executing visceral hyperaemia is the "inosculation circle."

The object of an "inosculating circle" is to engorge its peripheral viscus and transport blood volume from one viscus to another.

A maximum blood volume occupying an "inosculation circle" exacerbates common visceral function (sensation, absorption, secretion, peristalsis). The solidarity and compactness of the anastomosis of the arteries of the intestinal tract enables it to concentrate circulation in any local segment requiring increased localized function (sensation, secretion, absorption, peristalsis).

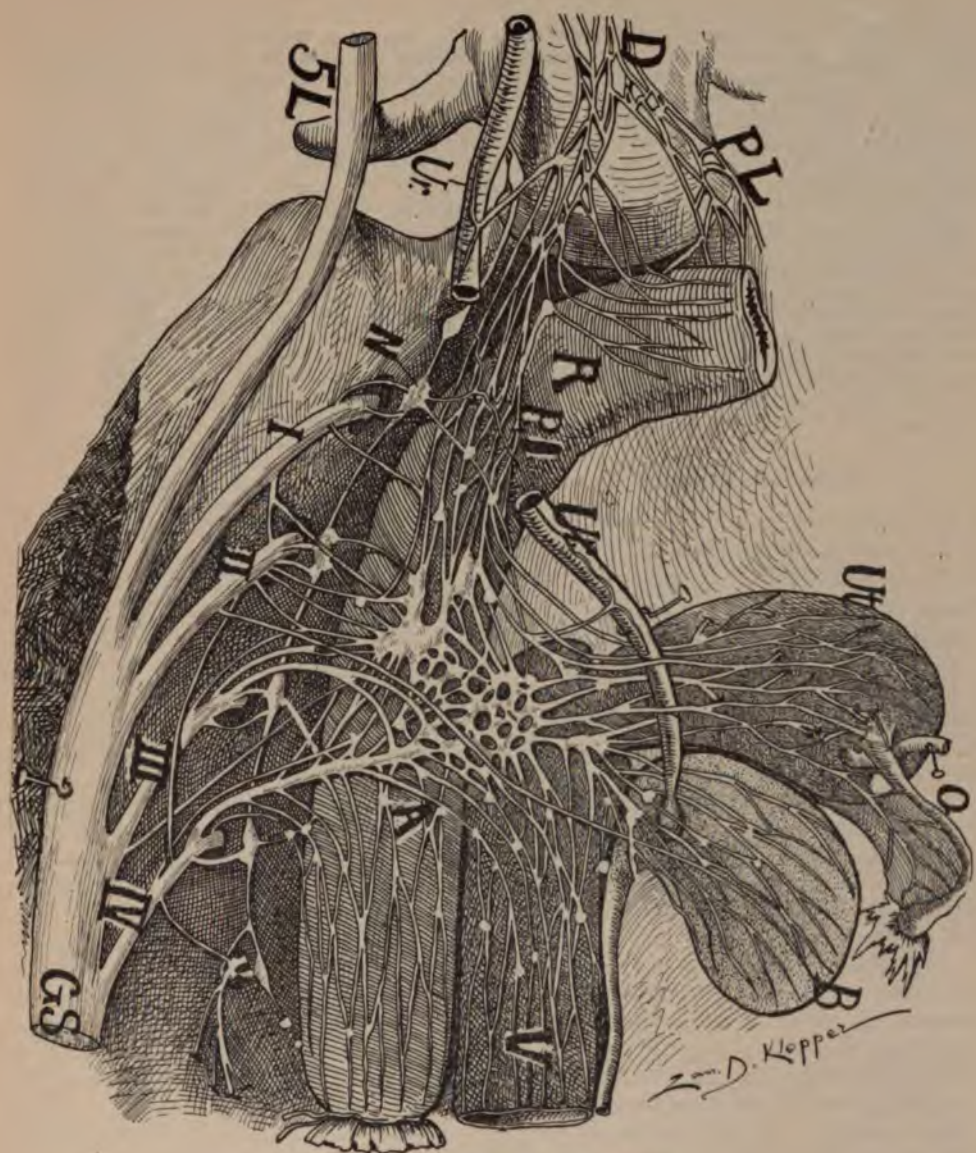
The inosculating circle is the direction of least resistance.

SECTION V.

MANAGEMENT OF THE BLOOD VESSELS DURING INTESTINAL RESECTION FOR SYPHILITIC, CARCINOMATOUS OR OTHER OBSTRUCTION OF THE TRACTUS INTESTINALIS

Resection for the relief of intestinal obstruction is a fairly frequent factor, however, the one cry is "late diagnosis and still later operation." Diagnosis in some cases of intestinal obstruction especially in the rectum and colon is so difficult that it cannot be made without a therapeutic test as the KI test. Syphilis of the tractus intestinalis is not of rare occurrence and no doubt that frequently a syphilitic neoplasm is removed for a carcinomatous one—with, of course, recovery. Among the last six patients sent to me for rectal obstruction diagnosed as carcinoma, two only were carcinoma and four were syphilis. Such subjects possessed neoplastic swellings so far advanced that sigmoidostomy alone was executed immediately to save life. Subsequent to the sigmoidostomy 100 grains daily of KI should be tried. It is surprising how many of the rectal obstructions gradually disappear. Doubtless syphilitic neoplasms are relatively frequent in other segments of the tractus intestinalis and as relatively frequently removed for cancerous growths. I learned from that brilliant genius, the late Mr. Lawson Tait, while his pupil in 1891, that the tractus intestinalis is frequently attacked by spyhilitic neoplasm. When the rectum is sufficiently healthy to functionate the sigmoidostomy may be repaired and the faecal current resume its rectal route. My subject is resection for relief in intestinal obstruction, however, my theme is the blood vessels of the tractus intestinalis in relation to the resection. In intestinal obstruction the blood supply has heretofore not demanded significant attention, being considered as a nonimportant matter. However, as a matter of fact the majority of fatalities subsequent to resection for intestinal obstruction have been due to excessively damaged blood vessels which included tissues of defective healing and made them excessively susceptible to infection. I shall place the blood supply of the tractus intestinalis as the prime factor of success and vascular strangulation as the doom of the patient. If the operation for resection be delayed until the intestinal lumen be obstructed the result will probably be fatal from sepsis and vascular strangulation. In general the intestinal vessels are damaged long previous to the obstruction of the intestinal lumen as is evident either from the parietal atrophy (distension) or hypertrophy proximal to the obstruction. It is blood that cures disease and the walls of evacuated intestines in the state of quietude are quite thick and so richly vascular that the blood supply acts as a phophylactic against pathogenic germs. If the walls or the parieties of the intestine be excessively distended by obstruction of the fæcal circulation the intestinal blood vessels became damaged, strangulated and the blood supply becomes seriously impaired and sepsis runs riot. Chronic intestinal parietal distension produces vascular atrophy as in the distended giant sigmoid. Damaged, strangulated, septic vessels accompany defective healing. The vascular degeneration of the intestinal parietes proximal to the obstruction is rapidly increased by the septic state of the contained fluids. Hence the operator should resect widely distant from the seat of obstruction—it may require several feet of intestinal resection to secure normal vessels.

The chief importance in operation in intestinal resection is the management of the blood supply which I will here demonstrate by original dissections.



PELVIC BRAIN OF AN INFANT.

Fig. 84. A, pelvis brain; B, plexus vesicalis; V, plexus vaginalis; I, II, III, IV, V, sacral nerves with the sacral ganglia (N), plexus (hypograstricus); P. I. Ur., ureter; Ut., uterus; B, bladder; v, vagina; R, rectum; O, oviduct. 5 L V, lumbar nerve; D, interiliac nerve disc.

The pelvic brain in this infant, viewed with a lens, present the afferent nerves arriving from the plexus interiliacus (P. I.) nervi sacrales, ganglia sacralia, mainly as single nerve cords, at most slightly plexiform at the distal end of the plexus interiliacus. With a magnifying lens the efferent nerves of this pelvic brain (plexus rectalis, vaginalis, vesicalis, uterinus) resemble luxuriant leashes (cat o' nine tails) or richly ganglionated plexuses. The pelvic brain in this subject has the following efferent leashes: (a) the plexus rectalis presents some seven emissions of large nerves, coursing distalward on the rectal wall, richly supplying the rectum. It has the most limited number of nerve trunks and ganglia of any of the efferent elashes of the pelvic brain; (b) plexus vaginalis presents some eight emissions of large, strong nerves for the vagina. The nerve supply to the vagina (plexus vaginalis), of richly ganglionated plexus appears more luxuriant, enormous, profound, than that of the uterus, because it is more on the surface, more apparent to the lens and unaided eye. The

ganglionated plexus vaginalis surrounds the vagina from the proximal to the distal end with a mighty net work, which in its richness resembles the network of cords surrounding a rubber ball. The proximal end and ventral vaginal wall are the most richly supplied; (c) the plexus vesicalis presents some six emissions of large strong nerves for the bladder (besides a large strong nerve which arises from the II sacral and passes directly to the the bladder. The bladder is richly supplied by an extensive ganglionated plexus; (d) the plexus uterinus presents some twelve emissions of large nerves passing from the pelvic brain to the uterus. With a lens one can count five of the trunks of the plexus uterinus coursing to the uterus external to the ureter, and about seven trunks pass to the uterus median to the ureter. Also one large or two small strands of nerves pass directly from the plexus interiliacus (hypogastricus) to the uterus without first entering the pelvic brain.

The nerve supply (in this subject) to the uterus (plexus interinus), a richly ganglionated plexus, is luxuriant, enormous, profound. This infant's uterus and vagina demonstrate that they are profoundly supplied by a richly ganglionated fine nerve plexus which is intimately woven on their surfaces and richly distributed through their parenchyma. The uterus, like the heart, appears to possess single ganglia to rule its functions should the local ruler, the pelvis brain, become incompetent.

The genital ganglia rule the caliber (and consequent blood volume) of the genital "inosculation circle." They are master of the 7 functions of the genitals.

Views on Vascular Landmarks of the Tractus Intestinalis.

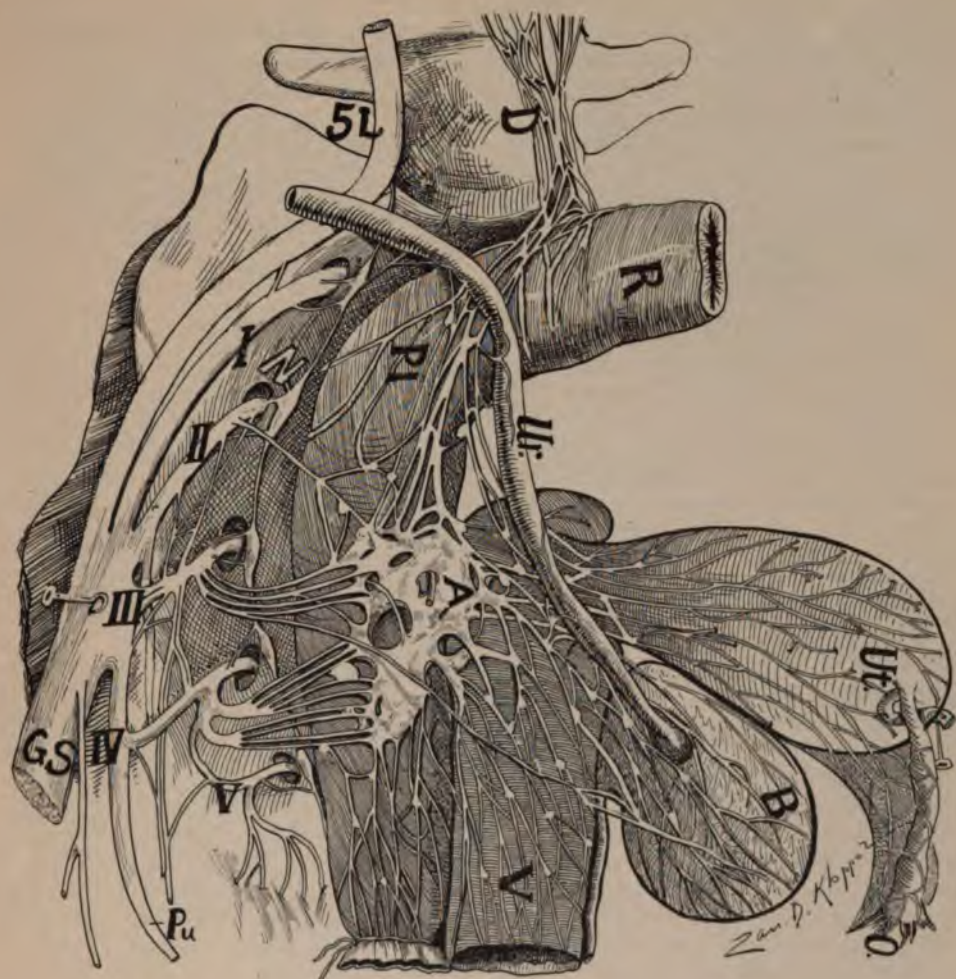
A landmark is a point for consideration; anatomic, physiologic, pathologic. After dissecting the arterial circulation of the tractus intestinalis in 65 consecutive subjects, I became convinced that the observation of certain anatomic facts in intestinal resection would be useful in saving the life of patients by avoiding death from gangrene. Recently I read of seven deaths following intestinal surgery due to gangrene. I shall propose five vascular landmarks for consideration: Anatomic, physiologic and pathologic. The five vascular land marks are: *"The ileocolic arches," "the concentric gastric circles," "the straight terminal vessel of the intestine," "the ileocolic circle," "entero-colic circle."*

The arrangement or plan of the blood apparatus to gastrium, enteron and colon is theoretically identical, however, practically may require different surgical procedures. The general arrangement of the blood apparatus to the tractus intestinals consists of: (1), *vascular trunk* (truncus vascularis); (2), *mesenteric vascular arch* (arcus mesentericus vascularis); (3), *straight terminal vessel of the intestine* (vas intestini terminale rectum).

In other words the practical plan of the intestinal blood apparatus is that of "trunk," "arch," "straight terminal vessel," each of which demand absolute respect in intestinal surgery. This plan in general is thoroughly applicable to gastrium, enteron, colon. In gastric operation the surgeon ligates the "vascular arch," in colonic and enteronic surgery he ligates the "straight terminal vessel," in the ileo-coecal junction surgery he can ligate the "vascular arch" (the "ileocolic arches") which possess straight terminal vessels. Though theoretically the arrangement of the blood apparatus to the tractus intestinalis is exactly identical (trunk, arch, straight terminal vessel) in practical surgery there are different localities which demand practically different procedures. The localities of the tractus intestinalis which require different surgical technique as regard the vascular apparatus are: Gastrium, enteron, colon, ileocoecal junction.

Fig. 1. The Gastrium.

By reference to Fig. (48) and (49) it will be observed that the arrangement of the blood apparatus to the gastrium is: (1), vascular trunk (celiac axis); (2), vascular arch ("concentric gastric circles"); (3), "straight terminal vessel" of the stomach (which are the terminal straight vessels emitted from the concentric gastric circles (arches). In gastric surgery the "straight terminal vessel" is ignored and the gastric arches ("concentric gastric circles") are



PELVIC BRAIN.

Fig. 85. An illustration of the pelvic brain, drawn from my own dissection. The plexus interilacus (hypogastricus) is distinct presenting two terminations—viz.: (a) one part (P) terminates in the uterus without passing through the pelvic brain (B). The other portion of the plexus interiliacus terminates in the pelvic brain (B). The source of the nerves which compose the pelvic are (a) interiliac plexus; (b) the sacral plexus; (c) the sacral ganglia. It may be observed that there are small ganglia on the rectum, bladder and vagina and uterus. The pelvic brain rules the physiology of the tractus genitalis; it is a brain, it is a receiver, a reorganizer and an emitter of nerve force. The pelvic brain includes in its dynamics the initiation, maintenance and conclusion of labor. G.S., great sciatic. Pu.. pudic nerve. S. G., sacral ganglia. R., rectum. V., vagina. X represents the nerve which arises from the III sacral and ends in the bladder. H., interiliac dics. U., ureter. C. I., common iliac artery. 16. vasa ovarica crossing the ureter. Ov., ovary. O. D., oviduct. Observe the solid ganglionic mass (A) as a pelvic brain. Note the peculiar origin from the sacral nerves and the tailed division. The pelvic brain is but slightly fenestrated.

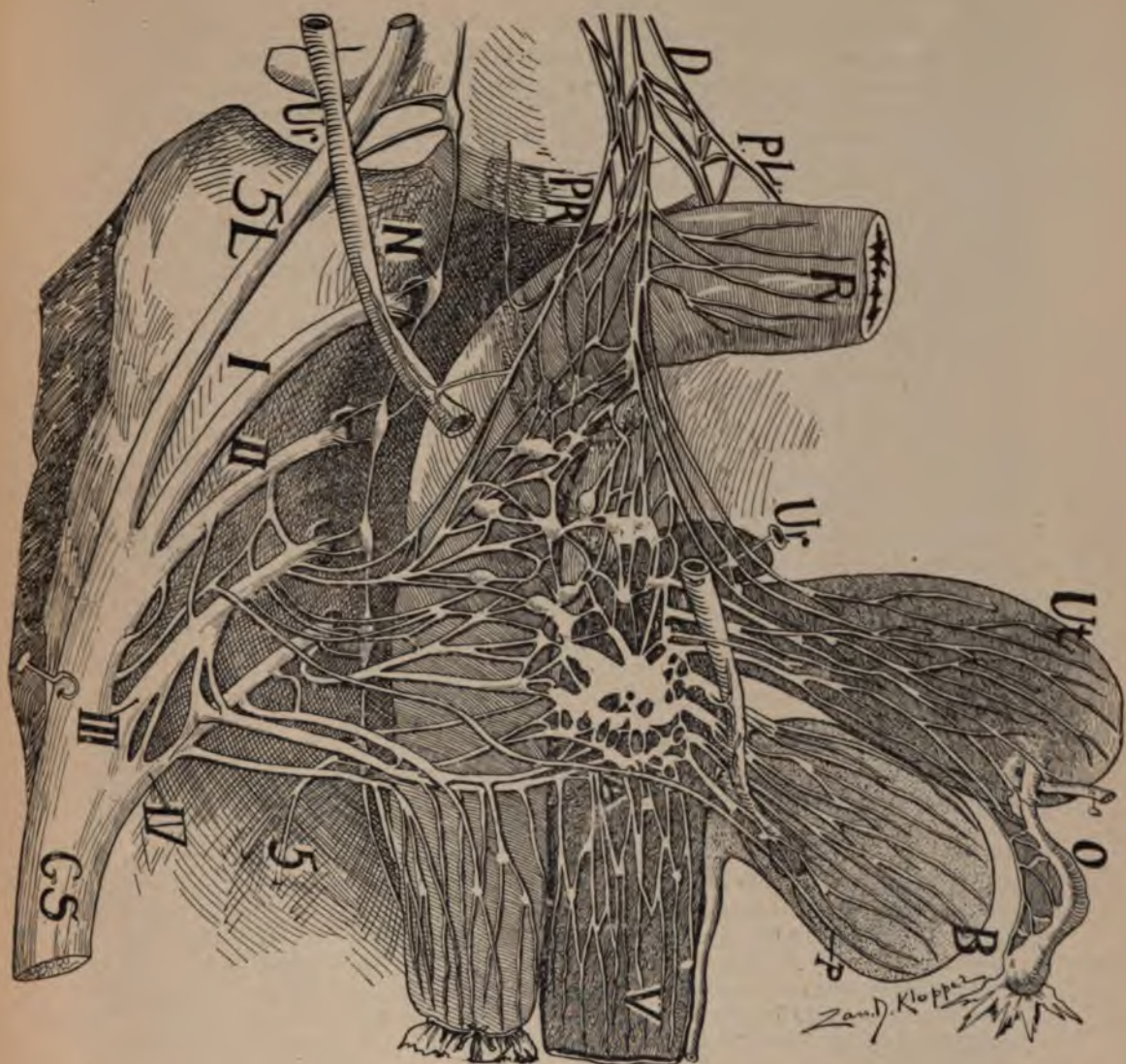
The genital ganglia controls the lumen of the genital "inosculation circle." The automatic genital ganglia perside over the 7 genital functions through controlling the blood supply.

ligated or clamped. An exception in the blood vascular apparatus of the stomach places it in the identical surgical procedures of the enteron and colon, i. e., the vasa brevia (V. B. in fig. (48) and (49) belong to the "straight terminal vessel" of the stomach and must be clamped or ligated to gastrectomy. (A note may be of interest to the effect that during the dissection of the tractus

vascularis of the tractus intestinalis in 65 subjects I found 5 individuals possessing a strong hepatic branch emitted from the arteria gastrica, hence in ligation of the gastric artery, the anomalous hepatic branch must be respected). The stomach is rich in blood supply and its "straight terminal vessel" anastomoses solidly and compactly with its fellow on the dorsal and central gastric surface. In partial gastrectomy the "concentric gastric circles" will be interrupted by the ligature. In visceral surgery the arrangement and blood supply of every viscus must be respected if success be expected—as it is blood that heals wounds and cures disease. Previous to gastric operations all solid food should be withheld and gastric lavage practiced.

Fig. 2. Resection of the Enteron.

Intestinal surgery is no more a pioneer matter and it behooves the surgeon to operate successfully. We will illustrate the technique of enteronic resection, as regards blood supply by the original figures (39), (45), (66), and (46). I dissected these specimens and Zan D. Klopper, the artist, sketched them from nature as models. I suggest especial attention to what I am terming "*vas intestini terminale rectum*" or "*straight terminal vessel of the intestine*" located along the enteronic border. The vessel is located between the mesenteronic arch and the entronic border. The vessel measures from one-half to two inches and is of ample length to ligate or especially to clamp without compromising the mesenteronic arch. It will be observed in these three figures (39), (45), (66), (46) that the "*vas intestini terminale rectum*" or "straight terminal vessel of the intestine" is the least in length at the distal end of the ileum where the enteron receives the least quantity of blood of any intestinal segment. This minimum quantity of blood supply at the distal ileum accounts for the destructive ulceration in Peyer's patches in typhoid fever and tuberculosis. However, the "straight terminal vessel of the intestine" is of ample length even at the distal lieum for clamping or ligature without disturbing effectually the mesenteronic arches except the short, strong "ileo-colic arches" which are practically interpolations, separate from the mesenteronic arches. However, by resections in both dog and man I found that even the distal end of the ileum, the segment possessing the minimum vascularity of the entire enteron, heals more vigorously and efficiently than the colon. It, however, becomes amply evident (from the illustrations) that any segment of the distal enteron may be resected with absolute safety to the "ileo-colic circle"—the one constant mesenteronic arch that safely conducts ample blood for iliac nourishment. The "ileo-colic circle" is significant as it practically originates the arteria appendicularis. The operator may make the clamping or ligating doubly sure for the safety of the mesenteronic arches by liberating by a slight blunt dissection presenting ample length of the "straight terminal vessel of the intestine." I suggest also that the "straight terminal vessel of the enteron" can be clamped with strong crushing clamps with greater safety to the mesenterial arches than by ligation. The crushing clamp should be allowed to remain in situ for a couple of minutes. The "straight vessel" of the intestine requires a clamp only like the rami laterales uteri. By a study of the figures (39), (66), (45), (46), it will be evident that in enteronic resection lateral anastomosis will probably be more safe than circular enterorrhaphy on account of the greater certainty of persistence of the "straight vessel" than in the former operation, however, circular enterorrhaphy will afford more liberal and immediate faecal current. The enteronic resection should be accomplished in absolutely healthy intestine though several feet of intestine be sacrificed because it insures more certain healing (especially observe fig. (66) and perchance avoids thrombotic vessels and subsequent embolism. A glance at the figures (39), (45), (66), (46), will at once suggest that more of the enteron should be resected on the distal than on



PELVIC BRAIN OF AN ADULT.

Fig. 86. Drawn from my own dissection. A., pelvic brain. In this case it is a ganglionated plexus possessing a wide meshwork. Also the pelvic brain is located well on the vagina, and the visceral sacral nerves (pelvic splanchnics) are markedly elongated. V., vagina. B., bladder. O., oviduct. Ut., uterus. Ur., ureter. R., rectum. P. L., plexus interiliac (left). P. R., plexus interiliacus (right). N., sacral ganglia. Ur., ureter severed to expose the pelvic brain. 5L., last lumbar nerve. I, II, III, IV, sacral nerves. 5, coccygeal nerve. Observe that the great vesical nerve (P) arises from a loop between the II and III sacral nerves. G. S., great sciatic nerve.

The genital automatic ganglia controls the caliber of the utero-ovarian artery—the genital "inosculation circle," which consists anatomatically of: (a), a vascular arc; (b), automatic peripheral ganglia; (c) peripheral viscus (genitals).

Physiologic, the stimulation of the automatic genital ganglia dilates the genital "inosculation circle" initiating common visceral function (sensation, secretion, absorption, peristalis) and special function (ovulation, menstruation, gestation).

the proximal side of the mesenteron to secure vital vascularized tension. In fact, in dog shooting experiments I lost several dogs from bullets penetrating the

junction of the mesenteron and enteron (i. e., destruction of the "straight vessel") before I realized the fatal factor which I found at autopsy. The "vas intestini terminale rectum" had been severed by the bullet. In dog or man (it occurred to me in both) subsequent to lateral anastomosis or enterorrhaphy invagination may occur. This should be avoided by fixation sutures omental grafts. In the dog I avoided invagination by temporary suturing a 3-inch rubber tube in the intestinal lumen at the site of operation. In enteronic resection I prefer circular enterorrhaphy for the most useful immediate and remote function. I first suture the intestinal ends together by a continuous running suture of linen thread on a milliner's needle which penetrates the 3 coats—serosa, muscularis, mucosa.

Second, I used a Lembert suture which in form resembles a Matras suture. One can also use a partially continuous and interrupted suture. I finally fortify the sutures by omental grafts severed or unsevered. The enterorrhaphy is completed in 10 to 15 minutes. Precaution should be exercised that the enteron is safely nourished on its mesenteronic border by the healthy "straight terminal enteronic vessel." In both dog and man circular enterorrhaphy has produced the best immediate and remote function as in lateral anastomosis there is first more or less obstruction to the intestinal contents.

And later I have observed in dog that lateral enteronic anastomosis is accompanied by accumulations of intestinal contents—hair, fibres, gravel, indigestible material. It is my experience that in numerous dogs and considerable clinical labors in hospitals that healing in the healthy enteron is remarkably certain. The enteron possesses a maximum blood supply and it is blood that heals. One should avoid passing sutures through mesenteric glands as the suture may infect the gland and the enteron is rich in glandular apparatus.

3. Resection of the Colon.

For resection of the colon as regards blood supply the reader's attention is directed to figures (39), (45), (46). At first view it would appear that the "*vas intestini terminale rectum*" or "straight terminal vessel of the intestine" (colon) is not applicable in colonic resection. This point is especially prominent along the right and left colon where the meso-colonic arches rest on the ventral surface of the colon (especially—fig. (45)—). However, the "straight terminal vessel of the intestine" is absolutely present and of sufficient length to clamp or ligate with safety to the meso-colic arches. Slight, blunt, dissection liberates it to ample length for the crushing clamp which is safer than ligation. In colonic resection it is more important to recognize the "straight terminal vessel of the intestine" (colon) than it is in the resection of the enteron as the mesenteronic vascular arches are more limited in dimension, greater in number, more compact in anastomoses, more certain in collateral inosculation, and located at a greater distance from the enteron than those of the mesocolon. The mesocolic vascular arches are characterized by magnitude, limitation of number, noncompact anastomosis, limited in collateral inosculation, and adjacent approach to the colon. The dimension of the meso-colic arches vary within extensive limits. The right colon, transverse with left colon and sigmoid differ in the vascular supply (trunk, arch, straight terminal vessel) sufficiently to demand study. The factor in the meso-colic blood supply which requires practical attention is the "meso-colic arch." The lymph apparatus of the colon is atrophying from repeated septic processes and this factor enhances the safety of colic operation by limiting the transportation of infection.

(A), Resection of the Right Colon.

In resecting the right colon the meso-colic arch may not infrequently be found actually resting against the internal lateral colonic border and on the ven-

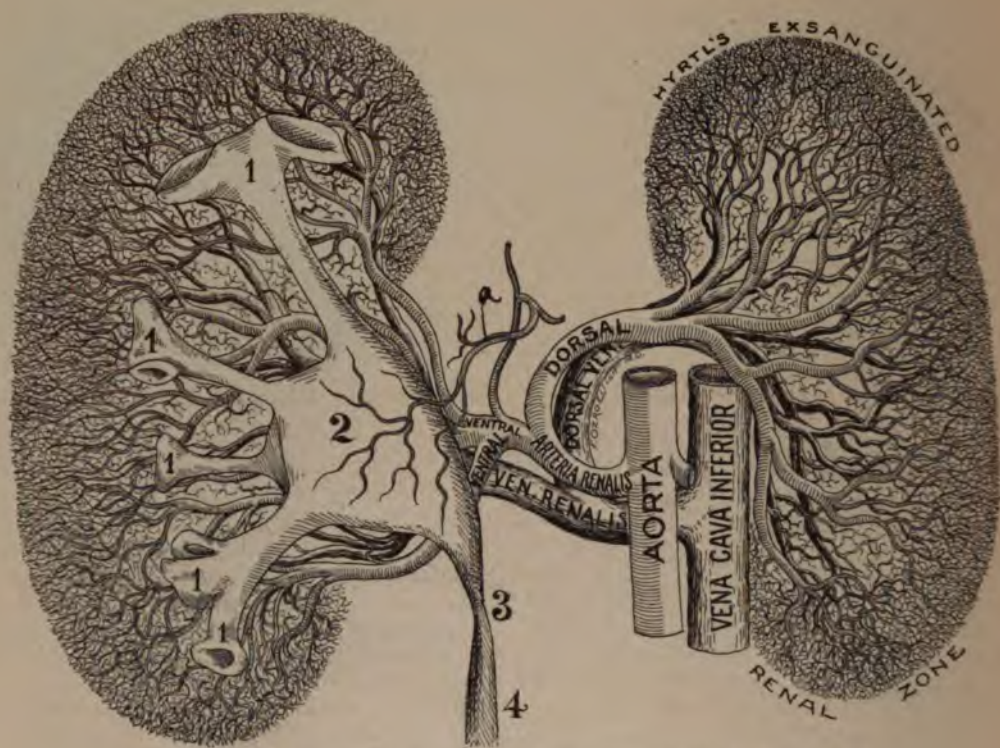
tral surface (see figure (45)—). The "straight terminal vessel of the colon" may be liberated by blunt dissection with facility for clamping or ligation without jeopardizing the anastomozing meso-colic arch. In fat subjects matters may appear doubtful as to avoiding the "mesocolic arch," however, by traction —forcing the colon and arch asunder and slight, blunt, dissection the clamping of the "straight terminal vessel of the colon" may be accomplished without compromising, molesting the mesocolic arches. By the dissection of 65 subjects I found that in every single individual the "vas intestini terminale rectum" (colon) was ample in length to be clamped or ligated safely as regards to Riolan's or Haller's arch. By reference to the figures (39), (45), (46), it is evident that in each subject ample length is present in the "*vas intestini terminale rectum*" (colon) to become ligated or clamped with safety to Riolan's or Haller's arch.

(B), Resection of the Transverse Colon.

For this subject see figures (39), (45), (46). Note the "Enterocolic circle" or Riolan-Haller's arch extending along the major length of the colon transversum and that the major segment of the transverse colon is nourished by the "straight terminal vessel of the colon" which emerges from this greatest arch of the body (20 inches in length)—arcus transversi coli, anastomotica maxima. Frequently arches of minor magnitude are located on the periphery of Riolan's or Haller's arch as may be noted in this figure. In colonic resection as regards the blood supply the most important segment is the transverse colon where is located the Riolan-Heller's arch—anastomotica maxima—and its severance doubtlessly would doom the patient to death from gangrene. However, I could inject the entire length of the intestine either through the arteria mesenterica proximal or distal. If the "entero-colic circle" Riolan-Haller arch be ligated the general intestinal circulation would continue but some localized point would be liable to gangrene. The "entero-colic circle" Riolan-Haller's arch is a contant structure, however, its dimensions—length and diameter—vary on account of the adjacent accessory arches of the arteria colica dextra and sinistra.

(C), Resection of the Left Colon.

The left colon extends from the splenic flexure to the point where it turns rightward, i. e., at Schiefferdecker's angle to pass ventral to the psoas muscle. It averages nine inches in length and possesses a mesocolon in perhaps 5% of subjects. Though the left colon is practically the beginning (the proximal end) of the faecal reservoir it is generally in an evacuated state. Since the left colon is practically without a mesocolon difficulty arises in delivering any neoplastic mass. The left colon should be cleaved from the dorsal wall by forcing the left colon with the peritoneum and subperitoneal tissue medianward. This avoids rupture of colonic vessels. As regards the arrangement of the blood vessels fig. (45) presents a frequent occurrence. The left colic arch may lie ventral to the surface of the left colon, however, the "straight vessel of the colon" is exposed by slight blunt dissection and presents ample length for clamping without compromising the mesocolic arches and intimately approaches the border of the left colon. Resection of the left colon for relief of colonic obstruction is quite fatal, perhaps the trauma required and solid faecal masses present to remove the neo-plastic mass accounts for many fatalities. If the neoplasm in the left colon be advanced it would be safer to cleave and free the colon and its attached blood vessels deliver and fix it in the abdominal wound. Subsequently, as opportunity presented, amputate the neoplasm leaving the two severed ends of the colon in the wound presenting the appearance of a double barreled shotgun. Later by aid of clamps the interrupted colonic lumen might be restored. If I resect the left colon I perform circular colporrhaphy.



VESSELS OF THE TRACTUS URINARIUS. CORROSION ANATOMY.

Fig. 87. This specimen presents quite faithfully the circulation of the kidney, calyces and pelvis. The two renal vascular blades I present opened like a book. The corrosion was on the left kidney and the larger vascular blade is the ventral one. The vasomotor nerves accompanying the urinary tract may be estimated by the fact that a rich plexiform network of nerves ensheath the arteries, the calyces, pelvis and ureter proper. When the renal vascular blades are shut like a book their thin edges come in contact, but do not anastomose. The edges of the vascular blades are what I term the exsanguinated renal zone of Hyrtl who discovered it in 1868, and we, at present, employ it for incising the kidney to gain entrance to the interior of the calyces and pelvis with minimum hae morrhage.

I introduce this illustration to present the renal circulation as differing from that of the tractus intestinalis.

The renal arteries are end arteries and the pheripheral ends of the arteries of each renal blade do not inosculate.

It is preferable to lateral colonic anastomosis. Circular colorhaphy does not heal with the vigor and certainty of circular enterrorrhaphy. The blood supply of the left colon is not so rich as that of the enteron.

(D) Resection of the Sigmoid Flexure.

The sigmoid flexure is the faecal reservoir. It extends from the point where the left mesocolon turns transvesely to pass ventral to the psoas (i. e., at Schiefferdecker's angle) to the proximal end of the rectum. Its length averaged in 700 personal autopsies, 17½ inches in woman and 19½ in man. I have observed it 40 inches in length (giant sigmoid) and again I have observed it six inches in length. Its mesosigmoid averages 3½ inches in length. The mesosigmoid possesses over 80% of mesosigmoid adhesions due to trauma of the psoas muscle. It is the most mobile intestinal segment. The mesosigmoid is the most powerful and strong of all intestinal mesenteries. In other words its mesenterii membrana propria or mesosigmoid proper contains the maximum quantity of fibrous

tissue of any colonic segment. Since the sigmoid flexure is a faecal reservoir and its contained faeces—generally a solid column of desiccated fæces—offer especial dangers and difficulties in resection which should be studied as regards the operation being performed in one or two tempos. Solid faeces—scybala—endanger the integrity of sutures during peristalsis—especially with limited blood to the walls. However, the less blood, the less peristalsis for it is blood that produces intestinal function (sensation, peristalsis, absorption and secretion). The chief diseases producing obstruction in the sigmoid are: Volvulus (60% of all intestinal volvulus) neoplasm, stricture, the giant sigmoid (enormous dilatation of sigmoid—over 25 inches in length), sigmoid perforation (left iliac fossa abscess), sigmoiditis.

The blood supply of the sigmoid is rich in trunks, arches and "straight terminal sigmoid vessels."

The mesosigmoid vascular trunk is the root of the arteria mesenterica distal. It is from ½ to 2 inches in length and of ample dimensions to conduct a vast volume of blood.

The mesosigmoid arches resemble in number and form those of the "ileocolic arches." The mesosigmoid vascular arches are solidly and compactly anastomosed possessing a powerful circulation. The mesosigmoid arches vary in location, dimension and number (see figures (39), (45), (46)—). All the subjects presented duplicate mesosigmoid arches, many presented triplicate arches, and some presented quadruplicate arches.

The "straight terminal vessel of the sigmoid" or "vas intestinii terminale rectum" possesses dimension and number midway between the "straight terminal vessel of the colon" and that of the enteron. The "straight terminal vessel of the sigmoid" possesses a length from ½ inches to 2 inches, amply sufficient for clamp or ligature without molesting the mesosigmoid arch. The "straight terminal vessel of the sigmoid" is difficult to liberate or to free by dissection because it is firmly imbedded in great quantities of connective tissue. Also in 70% of adults the normal mesosigmoid is made much more difficult to dissect on account of the meso-sigmoiditis, i. e., a more or less quantity of connective tissue cicatrices is added or infiltrated in the mesosigmoid through inflammation due to psoas trauma. In one half the subjects the mesosigmoiditis wonderfully enhanced the difficulty of dissecting and exposing the "vas sigmoideae terminale rectum." The difficulty of dissecting the sigmoid vessels is increased toward the rectum. The rich maximum blood supply to the sigmoid furnishes ample reason why the sigmoid possesses minimum pathology. The sigmoid, with man's erect attitude, exists under the conflicting pathologic physiology of 80% of mesosigmoiditis which compromises it physiology, function (sensation, peristalsis, absorption, secretion) and anatomy, structure (gland, muscle, nerve, vessel, connective and elastic tissue). In sigmoid resection besides the difficulty of dissection the "straight vessel" for clamp or ligature there are two other difficulties, first the management in the faecal reservoir of the maximum, solid column of desiccated faeces and the management of the 75% of adult mesosigmoiditis due to psoas trauma. The above 3 difficulties, viz.: (a), of exposing proper vessels for clamping; (b), the management of the maximum solid column of desiccated fæces and (c), the cicatrices of the mesosigmoiditis frequently forces the operator to choose multiple tempo operation for sigmoid resection. A suggestion may be offered in sigmoid surgery and that is first to liberate, free, the sigmoid and mesosigmoid from its fixation by mesosigmoiditis (in 70% of subjects). A liberated, free sigmoid may be inspected, palpated, "straight vessels" clamped and surgical procedures performed on any of its segments. I prefer circular sigmoidorrhaphy to lateral sigmoid anastomosis. This operation has been successful during the past decade in the clinics of Dr. Lucy Waite and myself. In resection of the sigmoid the operator

is favored by the general fact that the sigmoid possesses a minimum lymph apparatus. Through Aeons of ages the numerous septic insults have largely obliterated the lymph apparatus of the sigmoid—hence the immunity to infection following sigmoid surgery. This explains the death records of colonic carcinoma when numerous patients die before the glandular or lymphatic apparatus is effectually involved. In sigmoid surgery of woman especially where the sigmoid has been perforated by a pyosalpinx or ovarian abscess the sigmoid is almost constantly perforated a sufficient distance proximal to the rectum to permit delivery of the liberated sigmoid throughout the abdominal wound allowing ample space for manipulation and surgical procedures.

4. Resection of the Ileocoecal Junction.

During the dissection of 65 consecutive subjects to expose and illustrate the appendicular circulation I found in the ileo-colic angle several strong, short vascular arches formed by the combined anastomoses of the arteria ileo-coecalis dorsal and ventral. This anastomosis I designated as the "ileo-colic arches" (see ileo-coecal region in figures (39), (45), (66), (46)—). A very important fact may be noted in the ileo-colic region and that is the "ileo-colic arches" emit terminal branches so that they may be ligated or clamped without effectually molesting the mesenteric arches. I found that the average number of "ileo-colic arches" for each individual was 6. Figure (39) possesses 7, fig. (45), possesses 8 and fig. (46) possesses 5 "ileo-colic arches." The anastomoses between the "ileo-colic arches" and branches of the arteria colica dextra is limited in dimension and signification. The same statement may be claimed as regards the anastomosis of the "ileocolic arches" with the vasa intestini tenuis. The "ileocolic arches" are an interpolation of mesenteric arches which once nourished a maximum herbivorous stomach, a second stomach—gastrium secundum (now the atrophying, dangerous treacherous appendix). The "ileo-colic arches" are an ancient primordial vascular landmark, at present directly related to the cecum. The appendicular vascular supply is the other remnant of the "ileocolic arches." At present the appendicular artery averages practically two arteries for each appendix and is of minimum dimensions. The "ileocolic arches" are absolutely identical with the general "mesenteric arches," for, the "ileocolic arches" emit the "straight terminal vessel" exactly similar to the mesenteronic, mesocolic, and gastric arches. However, in resection of the ileocoecal junction it is not practical to clamp the "straight terminal vessel" of the "ileocolic arches" as they are intimately related to the cecum and ileum and beside with the extirpation of the ileo-coecal junction the "ileo-colic arches" have accomplished their utility.

A significant matter exists, evident in the figures, that the ileocoecal junction may be extirpated without clamping or interrupting the "ileo-colic circle." Interruption of the "ileocolic circle" by ligature would probably place in jeopardy of gangrene intestinal segments, however, the jeopardy would be less dangerous than interruption or ligation of the "entero-colic circle," or Riolan-Haller arch in the region of the transverse colon.

General Directions.

In intestinal obstruction with no palpable swelling or neoplasm as a guide the median abdominal incision is advisable. When the intestinal coils project through the incision it is well to manipulate them as little as possible. Rather search at once for the cecum as a landmark in order to proceed either proximalward or distalward on the intestinal tract for the site of obstruction. If the intestinal coils are excessively distended or especially of a dark color, indicating vascular congestion, damage, it is wiser to make one or more intestinal incisions in the healthiest location on the distal side from the mesentery to evacu-

THE GENITAL "INOSCULATION CIRCLE."

(Utero-Oranian Artery).

Fig. 88. I introduce this illustration to demonstrate that a part of the peripheral viscus of an "inosculation circle" may be extirpated leaving the "inosculation circle" in situ and functionating e. g. I can remove the endometrium (endometrectomy) and part of the myometnum (partial myometrectomy) and leave the genital "inosculation circle" in situ and functionating. The line 7 indicates its direction of incision. Subsequent to endometrectomy and partial myometrectomy menstruation and gestation ceases, however, ovulation continues. By this method of operating, some functions may be suppressed while others may be preserved.

ate the gas and fluid. If the incision be in the enteron not only the gas but the fluid contents may be evacuated through a finger sized rubber tube.

Evacuation assists in locating the obstruction site without undue trauma. It gains space for manipulation and it indicates whether it would be wise to make a new abdominal incision over the located obstruction. If the obstruction be in the colon with large faecal accumulation and distension exist the colon should be incised and a half inch rubber tube inserted whence by injecting fluids and drawing one coil after another over the mouth of the rubber tube large quantities of faecal fluid may be evacuated.

My clinical labors and autopsies indicate that symptoms of obstruction of carcinoma palpably exist especially in the colon some time before marked glandular invasion.

Conclusions as Regards the Tractus Vascularis in Intestinal Resection.

The plan of the blood supply of the tractus intestinalis consists of: (1), a *vascular trunk;* (2), a *vascular arch;* (3), *straight terminal vessel.*

118541

LANE

MEDICAL LIBRARY

Gift
San Francisco County Medical
Society